

# City of Greensboro

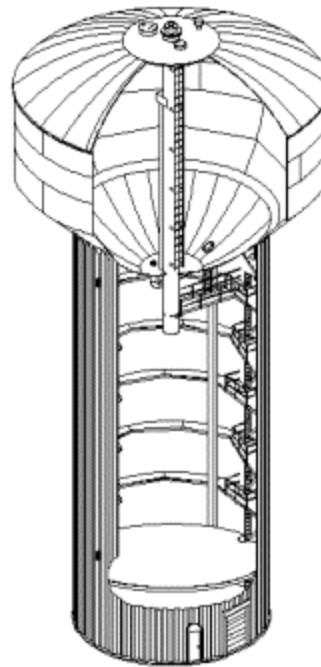
## North Carolina

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### Water Line And Sewer Line Construction

### Standard Specifications

*revised October 2003*



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## GENERAL REQUIREMENTS

### SECTION 1

#### 1.01 SCOPE OF WORK

##### A. Work Included:

Work under this contract shall include all implements, machinery, equipment, tools, materials, supplies, transportation, and labor necessary to construct the water lines, sewer lines, and appurtenances shown in the drawings and described in the contract documents. The Contractor shall perform all work in accordance with the lines, grades, dimensions, and other data shown in the drawings or as may be modified by written orders, and shall do such special, additional, extra, and incidental work as may be considered necessary to complete the work to the full intent of the drawings and specifications.

##### B. Work Not Included:

Work not included under this contract consists of any items designated in the Special Conditions as being work not included.

#### 1.02 ABBREVIATIONS AND REFERENCED SPECIFICATIONS

Wherever the abbreviations defined in this Article are used in these specifications, in any of the contract documents, or in the drawings, the intended meaning of such abbreviations shall be as defined in this Article.

Also, the specifications of the various organizations listed below shall apply whenever referred to in the contract documents.

AASHTO	American Association of State Highway and Transportation Officials
ABS	Acrylonitrile Butadiene Styrene
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AIISI	American Iron and Steel Institute
ANSI	American National Standards Institute, Inc.
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CI	Cast Iron
CRSI	Concrete Reinforcing Steel Institute
DI	Ductile Iron
F&I	Furnish and Install
F&L	Furnish and Lay
FSS	Federal Specifications and Standards, General Services Administration
HTH	High Test Hypochlorite
NCDOT	North Carolina Department of Transportation
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete Pipe
SSP	Steel Structures Painting Council
T&B	Trench and Backfill
UL	Underwriters' Laboratories, Inc.

### 1.03 INTERPRETATION OF QUANTITIES IN PROPOSAL

The quantities appearing in the proposal are approximate only and are to be used for the comparison of bids. Payment to the Contractor will be made only for the actual quantities of the various items that are completed and accepted in accordance with the terms of the contract.

### 1.04 GENERAL MATERIAL REQUIREMENTS

The current specifications of the American Society for Testing and Materials (ASTM), the American National Standards Institute (ANSI), the American Water Works Association (AWWA), the North Carolina Department of Transportation (NCDOT), and any other referenced organizations shall apply in all cases where material is covered by an item in those specifications, and all material used under this contract shall conform fully to those current specifications or be removed from the job at the direction of the Engineer. Failure of the Engineer to condemn materials on preliminary inspection shall not be grounds for acceptance if future defects are found.

### 1.05 GENERAL MATERIAL AND COMPACTION TESTING REQUIREMENTS

The City will perform such destructive and non-destructive testing as it deems necessary; procedures will follow those of the American Society for Testing and Materials (ASTM), the American Association of State Highway and Transportation Officials (AASHTO), or other appropriate testing related organizations. The City reserves the right to modify testing procedures for backfill compaction to allow a deeper test to be made using the sand-cone method; nuclear testing gauges may be employed for density measurements.

Material specimens shall be subjected to tests by an independent testing laboratory at such time as the Engineer may direct. The cost of the materials and testing will be borne by the City. The Engineer will order rejection of materials not meeting specifications, and such materials shall be immediately removed from the job.

The Contractor may at any time employ an approved independent testing agency to check the results of tests conducted by the City. Should such tests prove that the City test results are incorrect and the employed agency test results are within the limits specified, the cost of the employed agency tests will be borne by the City; otherwise the Contractor will bear the cost.

### 1.06 CONTROL OF MATERIAL

#### A. Delivery and Handling of Materials:

All materials shall be handled carefully and in such manner as to preserve their quality and fitness for the work. Materials damaged during delivery or handling shall not be used without approval of the Engineer.

#### B. Storage of Materials:

Materials shall be so stored as to insure the preservation of their quality and fitness for the work. Stored materials, which may have been approved before storage, shall be subjected to inspection at any time, and shall meet the requirements of the specifications

at the time they are put into use. Stored materials shall be so located as to facilitate their inspection. Subject to the approval of the Engineer, that portion of the right-of-way not required for public travel may be used for storage purposes and for the Contractor's equipment, but any additional space required therefor shall be provided by the Contractor at no expense to the City. All storage sites located within the right-of-way shall be restored to their original condition by the Contractor at no expense to the City.

All waterline pipe and appurtenances that are to become a part of the City's water system shall be stored and handled in such a manner that no storm water or any foreign material will contaminate the interior surfaces.

All hydrants and valves shall be stored so that no damage from freezing will occur.

C. Responsibility for Material:

The Contractor shall be held responsible for all material furnished by him, and shall replace any material that is defective, damaged, or does not conform to the specifications at no expense to the City.

D. City Furnished Material:

The Contractor shall furnish all materials necessary to complete the work, except any materials specified in the Special Conditions to be furnished by the City. Payment at the contract price for the item which includes the use of City furnished material will be full compensation for all cost of handling and placing such materials after they are delivered or made available to the Contractor.

The Contractor will be held responsible for all material furnished to him, and deductions will be made from any money due him to make good any shortage and deficiencies from any cause whatsoever and for any damage which may occur after City furnished material has been made available.

E. Defective Material:

All materials which are not in conformity to the requirements of the specifications shall be considered as defective and such materials, whether in place or not, shall be rejected and are to be removed from the site of the work unless permitted otherwise by the Engineer. No rejected material, the defects of which may have been substantially corrected, may be used until the Engineer has given approval.

1.07 CONSTRUCTION STAKES, LINES AND GRADES

The Engineer will set construction stakes establishing lines and grades for the work as he may deem necessary, and will furnish the Contractor with all necessary information relating to lines and grades. These stakes shall constitute the field control by and in accordance with which the Contractor shall establish other necessary controls and perform the work.

The Contractor shall be held responsible for the preservation of all construction stakes, and if any of the stakes have been carelessly or willfully destroyed or disturbed by the Contractor, the cost to replace them will be charged against him and will be deducted from the payment for the work.

#### 1.08 ALIGNMENT AND GRADE

The Contractor shall install the water lines, sewer lines, and appurtenances to the lines, grades, and dimensions shown in the drawings. The Contractor shall not deviate from the lines, grades, and dimensions shown in the drawings unless the deviation is necessary to avoid a conflict with an existing structure, utility or other fixed object and written approval has been obtained from the Engineer.

The Contractor shall provide protection for all surface and underground structures, utilities, and other fixed objects. The protection methods shall be acceptable to the Engineer. The protection shall be provided by the Contractor at no expense to the City unless the drawings fail to represent the surface or underground structures, utilities, and other fixed objects adequately.

Where an existing structure, utility, or fixed object is parallel and in close proximity to the proposed water line, sewer lines, or appurtenance, and it is not practicable to relocate or remove it or to change the line, grade, or dimensions of the line or appurtenance, the Engineer will approve the use of special protective measures. The Contractor will not be allowed extra compensation unless the drawings fail to adequately represent the need for special protective measures.

The Contractor shall perform subsurface explorations where, in the opinion of the Engineer, it is necessary to determine the exact location of an existing underground structure, utility, or other fixed object, before the installation of the proposed work. The Contractor will be allowed extra compensation only for subsurface explorations that have been authorized by the Engineer prior to the exploration being done.

#### 1.09 MAINTENANCE OF TRAFFIC AND ACCESS TO RESIDENCES

The Contractor shall maintain traffic in accordance with all applicable provisions of Section 150 of the "2002 Standard Specifications for Roads and Structures" of the North Carolina Department of Transportation and the following provisions.

The Contractor shall provide and maintain adequate barricades, signal lights, flagger and other warning devices for the protection of traffic in conformance with the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways published by the Federal Highway Administration.

If, during the progress of a project, bad weather forces a delay of construction, the Contractor shall maintain in a safe and practical way the roadways used by the public or individuals so that neither may be unnecessarily delayed or inconvenienced on account of the work being carried on by the Contractor, the Contractor shall bear all costs associated with maintaining public traffic and access to individual residences to the satisfaction of the Engineer. This shall include, but is not limited to, the use of street maintenance stone.

The Contractor shall indemnify and save harmless the City and all its officials, agents, employees, from all suits, actions, or claims of any character, name or descriptions brought for or on account of any injuries or damages received or sustained in consequence of any neglect in maintaining traffic as specified.

No direct payment will be made for maintaining traffic as the cost of same shall be included in the contract prices for the various pay items.



#### 1.10 WORKING IN STATE HIGHWAY RIGHT-OF-WAY

The Contractor shall adhere to the North Carolina Department of Transportation's policies and procedures when construction is performed in State Highway right-of-way. Permits will be obtained by the City for installations in the highway rights-of-way; however, the Contractor shall notify the NCDOT prior to beginning work in said rights-of-way, provide, place, and maintain barricades, signs, danger lights, and other safety devices as required by the Department.

#### 1.11 VALVE AND HYDRANT OPERATIONS

The Contractor shall not operate any valve or hydrant within the City water system that has system pressure against it, without contacting the Inspector. The Contractor shall also contact the City of Greensboro Water Resources Department of Construction & Maintenance @ 336-373-2033 to obtain the permission and the necessary procedures that must be followed for valve or hydrant operations. The Contractor is required to contact the Water Resources Department of Construction & Maintenance @ 336-373-2033 to obtain permission and necessary procedures for each operation of system valves or hydrants.

The Contractor is hereby made aware of the fact that any violation of the above requirement is punishable as outlined in Chapter 22, Section 22-6.1, of the City of Greensboro Code of Ordinances.

#### 1.12 PROTECTION OF MAILBOXES

The Contractor shall be responsible for removal, preservation, and resetting of all mailboxes disturbed by construction operations. The mailboxes and their supports, when reset, shall be in a condition equal to or better than that existing before their removal. The Contractor shall maintain mailboxes during construction operations in such a condition that Postal Services will deliver mail to the boxes.

No direct payment will be made for removing, preserving, and resetting mailboxes or for maintaining mailboxes in Postal delivery condition as all such work will be considered incidental to other work being paid for under the various items in the contract.

Extra compensation will be made when, in the opinion of the Engineer, repair or replacement is required to properly reset a mailbox. This extra compensation will not be made for damages to mailboxes or their supports that is caused by negligence of the Contractor.

#### 1.13 PROTECTION AND RESTORATION OF PROPERTY

The Contractor shall be responsible for the protection from his activities of all public and private property on and adjacent to the work and shall use every reasonable precaution necessary to prevent damage to pipes, conduits, and other underground structures, and to trees, poles, wires, cables, and other overhead structures.

The Contractor shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer has witnessed or otherwise referenced their location and shall not remove them until directed.

The Contractor will be held responsible for all damage or injury to property of any character resulting from any act, omission, negligence, or misconduct in the prosecution of the work. When any direct or indirect damage or injury is done to public or private property by or on account of

any act, omission, negligence, or misconduct in the execution of the work, The Contractor shall either restore at his own expense such property to a condition similar or equal to that existing before such damage or injury was done, or shall make good such damage or injury in a manner acceptable to the owner of the damaged property and to the City. In case of failure on the part of the Contractor to restore such property or make good such damage or injury the City may, at the Contractor's expense, repair, rebuild, or otherwise restore such property in such manner as the Engineer may consider necessary.

#### 1.14 PROTECTION OF EXISTING UTILITIES

Reasonable care has been exercised in showing the location of existing utilities on the Plans. The exact location of such utilities is not known in all cases. The Contractor shall explore, at his own expense, the area ahead of ditching operation by observation, electronic devices, and by personal contacts with the utility companies, and locate such utilities in advance of the trenching operations, and shall conduct his work so as to eliminate or minimize damage to the existing structures or utilities. The Contractor shall be held responsible for any damages resulting from not exploring the area ahead, negligence, careless operations on his part, or damages to existing pipe, wire, structures, etc. All construction must conform to the underground utility protection act of North Carolina. BEFORE YOU DIG! CONTACT ONE-CALL CENTER @ 1/800-632-4949 as shown on plans.

Utility lines, such as telephone and electric, will be moved to proper location to the extent practical by others before the Contractor commences work.

#### 1.15 PAYMENT PROCEDURES

##### A. General:

Unless specified otherwise in the "Special Conditions" payment to the Contractor for completed work shall be made as outlined below:

(1) Payment will not be made on an individual water or sewer line until all work has been completed on the line and a final inspection has been made by the Engineer. If, in the opinion of the Engineer, the prevailing weather conditions are abnormal, the above payment procedure may be waived by the City. The above payment procedure will also be waived by the City when, in the opinion of the Engineer, the magnitude of the work involved on an individual water or sewer line is such that under normal working conditions the line could not be completed within one month.

When initial payment has been made on an individual water or sewer line before all work has been completed, the Contractor shall continue to pursue the work on the line diligently with workers in sufficient numbers, abilities, and supervision, and with equipment, materials, and methods of construction as may be required to complete the work as soon as possible. When, in the opinion of the Engineer, the Contractor is not pursuing the work diligently, the City will withhold payment on any contract work until such a time that diligent work progress is being accomplished by the Contractor.

(2) When approval for initial payment has been given by the Engineer, the Contractor shall receive, in the next monthly payment following this approval, 90% of the total money due him for the individual water or sewer line.

(3) The Contractor shall maintain the individual water or sewer line, or portion thereof, for a three month period immediately following the Engineer's approval for placing the water or sewer line in service. At the end of this three month period the Engineer, after another inspection of the site and the completion of any necessary maintenance work by the Contractor, will authorize final payment of all monies due for the individual water or sewer line minus retainage. The retainage will be released with the final payment for the entire contract.

(4) The Contractor's attention is directed to the twelve month warranty on materials and workmanship as outlined in the "General Conditions." This twelve month warranty period shall begin at the time of authorization for final payment as outlined in sub-paragraph (3) above.

At a mutually acceptable date and time, near the first day of each month, the Contractor shall submit a fully documented monthly estimate to the Engineer for approval. If deemed desirable by the City, the estimate shall be submitted at an estimate conference, the place of said conference to be agreed upon by both parties.

A copy of any documenting tickets required of the Contractor for work performed shall accompany each estimate.

The City will make payment to the Contractor for all completed and accepted work within 10 business days of receipt of an approved estimate from the Contractor. Payment of any monies to the Contractor is contingent upon the submittal by the Contractor of an estimated contract monthly cash flow schedule for the total contract period 20 days prior to the initial request for payment.

The provisions of Sub-Article 6.10 in the "Supplementary Conditions" must be met in regard to the itemized sales tax list.

**B. Mobilization Payment:**

Payment for "Mobilization" shall include all work and operations necessary for the initial movement of personnel and equipment to the project site; for the establishment of all offices, buildings, and other facilities necessary to begin work on the project; and for all other such fixed costs as may be reasonably charged to the initiation of a new project. Payment for this item will be made at the contract lump sum price for "Mobilization," which price and payment shall be full compensation for all measures within the scope of this pay item.

Payment for "Mobilization" will be made with the first estimate containing work items and will be made only once, regardless of the fact that the Contractor may have, for any reason, ceased work on the project, or moved equipment and personnel away from the project and then back again.

The City reserves the right to prorate the price bid for "Mobilization" over several estimates should, in the opinion of the Engineer, the price bid not be reasonable.

#### 1.16 SCHEDULE OF PROJECTS

When the contract contains several different projects, a project priority schedule will be set that is mutually agreeable to the Engineer and Contractor. However, the City reserves the right to set project priorities that are in the best interest of the City. The City, when exercising this right, will make every effort to set project priorities that are agreeable to the Contractor, but the importance to the City for the completion of a project and the affect that the completion of a project will have on the schedule of other predetermined public improvements will be taken into account in setting priorities.

#### 1.17 PAYOUT SCHEDULE

Within 30 days following the contract award, the Contractor shall prepare and submit to the Engineer two (2) copies of the proposed payout (cash flow) and construction schedule for the duration of the contract.

#### 1.18 CONTRACTOR'S REPRESENTATIVE

The Contractor shall represent himself or designate one person in his organization to represent him during the performance of the contract. The representative of the Contractor shall be authorized to supervise and direct the construction for the Contractor and to receive and fulfill directions from the Engineer.

#### 1.19 PRECONSTRUCTION CONFERENCE

A preconstruction conference will be held after award of the proposed work. The date for this conference is to be established immediately after award of the project.

#### 1.20 CONSTRUCTION CONFERENCES

After work on the contract has begun, construction conferences are to be held periodically. The construction conferences are to be scheduled at times that are mutually agreeable to the Contractor or his Representative and the Engineer. It shall be the responsibility of the Contractor or his Representative to attend the conferences.

#### 1.21 NIGHT AND WEEKEND WORK

No night or weekend work requiring presence of the Engineer or the Inspector will be permitted except in case of emergency and then only with the written consent of the Engineer and to such extent necessary.

This clause shall not operate for regular continuous night and weekend work.

Operation of mechanical equipment or other work of noisy nature will not be permitted between the hours of 9:00 p.m. and 7:00 a.m. except in the case of an emergency and then only with the written consent of the Engineer and to such extent necessary.

#### 1.22 CLEAN-UP

During construction of the project, the Contractor will maintain the work area and adjacent streets in as neat a manner as can be reasonably expected. In the event that

adjacent streets need to be cleaned or flushed due to negligence by the Contractor, the Contractor will be responsible for seeing that this work is done. Street cleaning services will not be provided by the City free of charge.

Upon completion of the entire project or any portion thereof, the Contractor shall perform all clean-up operations necessary to place the project in first class condition. For site improvement or plant projects, this shall include, but not be limited to; cleaning of all buildings, floors, walls, windows, equipment and grounds; removing and disposing of all excess materials, trash, debris, etc. It shall be the Contractor's responsibility to maintain the buildings and grounds in first class condition until final acceptance of the project by the City.

For street and utility projects, this shall include, but not be limited to; cleaning all area disturbed, right-of-ways, shoulders, streets, utility structures, etc. This shall also include removing and disposing of all excess materials, trash, debris, etc. Disturbed areas, between the curb line and limits of grading, shall be hand raked and all brick, mortar, rock, clods, and other debris shall be removed and disposed of.

It shall further be the Contractor's responsibility to maintain all areas disturbed until final acceptance of the project by the City.

#### 1.23 FINAL INSPECTIONS

When the Contractor has a project ready for final inspection, he will inform the Engineer in writing and a date will be set up for said final inspection. The Engineer or his representative will meet with the Contractor's representative, and they shall make a thorough inspection of the job. The Contractor shall furnish all labor necessary to open and inspect all manholes, catch basins, and valve boxes. A list of all deficiencies shall be made and the Contractor must correct them before acceptance of the project by the City.

On street and utility projects, the Contractor will insure that all structures are clear and free of debris and all valve boxes shall be clean, such that valve wrench can make solid contact with the operating nut prior to the above mentioned final. Miscellaneous brick, mortar, stone, asphalt, concrete or other debris shall be removed from the project and disposed. Hand raking of yards will have taken place and all seeding, mulching and erosion control completed. All meter boxes, cleanouts or other structures on the shoulder shall be uncovered and in plain view for the final inspection and shall match the surrounding ground elevation.

## MATERIALS SECTION 2

### 2.01 GENERAL DESCRIPTION

This section covers the materials to be used under Sections 3, 4, and 5 of these specifications.

### 2.02 WATER PIPE

#### A. Ductile Iron Pipe 3-Inch thru 12-Inch:

Water pipe three inch thru twelve inch nominal diameter shall be ductile iron pipe designed in accordance with ANSI A21.50 for a working pressure of 350 psi, and Laying Condition 1. Pipe shall be manufactured in accordance with ANSI A21.51 in 18-foot or 20-foot lengths. Pipe joints shall be push-on-type as per ANSI A21.51, Section 51-2-6. Pipe lining shall be cement mortar with a seal coat of bituminous material, all in accordance with ANSI A21.4.

#### B. Ductile Iron Pipe 16-Inch and Larger:

Water pipe sixteen inch nominal diameter and larger shall be ductile iron pipe designed in accordance with ANSI A21.50 for a working pressure of 250 psi, and Laying Condition 2. Pipe shall be manufactured in accordance with ANSI A21.51 in 18-foot or 20-foot lengths. Pipe joints shall be push-on type as per ANSI A21.51, Section 51-2-6. Pipe lining shall be cement mortar with a seal coat of bituminous material, all in accordance with ANSI A21.4.

#### C. Copper Pipe:

Two-Inch and smaller water pipe shall be Type K soft copper, conforming to ASTM B-88-62, with compression coupling connections as manufactured by Mueller, Ford, or equal.

### 2.03 SANITARY SEWER PIPE

#### A. Vitrified Clay Pipe:

Vitrified clay pipe shall be Extra Strength, designed and manufactured in accordance with ASTM C700. Pipe joints shall meet the requirements of ASTM C425.

#### B. Reinforced Concrete Sewer Pipe:

Pipe shall be designed under the provisions of ASTM C655 to meet the strength requirements of ASTM C76, Table 3, and the following provisions:

- 1) The pipe joints and joint materials shall conform to ASTM C361.
- 2) Cement shall be Type II Portland Cement as specified by ASTM C150, except that the tricalcium aluminate ( $3\text{CaO} \cdot \text{Al}_2\text{O}_3$ ) content shall not exceed 8%. The

Contractor shall submit to the Engineer a certificate from the cement manufacturer stating the guaranteed minimum tricalcium aluminate content.

- 3) Pipe shall be manufactured with calcareous coarse aggregate and have an Az life factor of 1.25 or greater. The Contractor shall submit to the Engineer a certificate from the manufacturer stating the guaranteed minimum Az life factor.
- 4) Lifting holes will not be allowed in the pipe.
- 5) The testing provisions of Article 4.12 apply to Reinforced Concrete Sewer Pipe as well.

C. Ductile Iron Pipe for Gravity Sewer:

Ductile iron pipe for gravity sewer shall be designed in accordance with ANSI A21.50 for a minimum working pressure of 250 psi. Pipe shall be manufactured in accordance with ANSI A21.51 in 18-foot or 20-foot lengths. Pipe joints shall be push-on type as per ANSI A21.51, Section 51-2-6. Pipe lining shall be cement mortar with a seal coat of bituminous material, all in accordance with ANSI A21.4. Laying Condition for gravity sewer will be determined by proposed depth and shall be based on ANSI A21.51, Table 51-1.

D. Ductile Iron Pipe for Sewer Force Mains 3-Inch thru 12-Inch:

Sanitary sewer force main pipe (three inch thru twelve inch nominal diameter) shall be ductile iron pipe designed in accordance with ANSI A21.50 for a working pressure of 350 psi, and Laying Condition 1. Pipe shall be manufactured in accordance with ANSI A21.51 in 18-foot or 20-foot lengths. Pipe joints shall be push-on type as per ANSI A21.51, Section 51-2-6. Pipe lining shall be cement mortar with a seal coat of bituminous material, all in accordance with ANSI A21.4.

All force main installations shall include the installation of a 12" wide polyethylene film that shall run the entire length and be installed 12" above the pipe. The tape shall be purple in color and have the following printed on it in 2.5" black block lettering, with no more than a 12" gap. "Caution Sanitary Sewer Force Main Do Not Drink". Tape to be a minimum of 5 mil in thickness and manufactured in accordance with ASTM-D-1000. Tape shall be as manufactured by F.E. Fulton, or pre-approved equal.

E. Ductile Iron Pipe for Sewer Force Mains 16-Inch and Larger:

Sanitary sewer force main pipe sixteen inch larger and shall be designed in accordance with ANSI A21.50 for a working pressure of 250 psi, Laying Condition 2. Pipe shall be manufactured in accordance with ANSI A21.51 in 18-foot or 20-foot lengths. Pipe joints shall be push-on type as per ANSI A21.51, Section 51-2-6. Pipe lining shall be cement mortar with a seal coat of bituminous material, all in accordance with ANSI A21.4.

All force main installations shall include the installation of a 12" wide polyethylene film that shall run the entire length and be installed 12" above the pipe. The tape shall be purple in color and have the following printed on it in 2.5" black block lettering, with no more than a 12" gap. "Caution Sanitary Sewer Force Main Do Not Drink". Tape to be a

minimum of 5 mil in thickness and manufactured in accordance with ASTM-D-1000. Tape shall be as manufactured by F.E. Fulton, or pre-approved equal.

F. ABS Composite Pipe:

ABS composite pipe shall meet the requirements of ASTM D2680. Pipe joints shall be elastomeric gasket, push-on type, in accordance with ASTM D3212.

G. PVC Composite Pipe:

PVC composite pipe shall meet all applicable requirements of ASTM D2680 and shall meet all performance standards of ABS composite sewer pipe. Pipe joints shall be elastomeric gasket, push-on type, in accordance with ASTM D3212. Polyvinyl compounds shall comply with a minimum cell classification of 12454B as defined in ASTM Specification D1784. PVC composite sewer pipe shall be certified by the manufacturer for each total contract until an ASTM Standard has been adopted.

H. PVC Sewer Pipe:

PVC sewer pipe shall meet the requirements of ASTM D3034, Type PSM, with a maximum SDR of 35. Pipe joints shall be elastomeric gasket, push-on type, in accordance with ASTM D3212. Polyvinyl compounds shall comply with a minimum cell classification of 12454B as defined in ASTM Specification D1784. Solid wall PVC pipe shall not be used for sewers larger than 15 inches in diameter.

I. PVC Open Profile Pipe:

PVC seamless pipe shall meet the requirements of ASTM F794 or ASTM F949 (latest revision). Polyvinyl chloride compounds shall comply with a minimum cell classification of 12454B as defined in ASTM Specification D1784. The pipe shall be homogeneous, and have a smooth interior with a solid cross-sectional exterior. Exterior shall be open profile with reinforcement perpendicular to the axis of the pipe to allow placement of the sealing gasket without field marking, beveling, sealing channels, gluing, welding, machining or additional cutting. The pipe stiffness at 5% deflection shall be a minimum of 46 psi when tested in accordance with ASTM D2412. Pipe shall meet ASTM D2444 requirements for impact resistance. Pipe shall have a 12 ft. minimum lay length. Each length of pipe shall be marked with the following information: size, company name or logo, PVC sewer pipe, ASTM F794 or F949 designation, manufacturer's code, and cell classification.

J. PVC Closed Profile Wall Pipe:

PVC closed profile wall pipe shall meet the requirements of ASTM F794. Pipe shall be structurally engineered for high-capacity gravity flow applications and suitable for sanitary sewer applications. Pipe shall have a high chemical and corrosion resistance and be inherently resistant to chemicals commonly found in municipal sanitary sewer systems. Polyvinyl chloride compounds shall comply with a minimum cell classification of 12364A as defined by ASTM Specification D1784. All pipe joints shall be of the bell and spigot type with elastomeric seals and conform to the requirements of ASTM D3212. Gaskets shall be factory installed and chemically bonded to the bell end of the pipe.



Gasket material shall conform to the requirements of ASTM F477. Joints shall be designed to sustain an angular deflection of up to 2° without leakage or loss of joint integrity.

Pipe shall exhibit a minimum stiffness of 46 psi when tested in accordance with ASTM D2412. A sample length of at least one pipe diameter shall be used as the reference test. No visual cracking or splitting shall be evidenced when tested in accordance with ASTM D2444 with a 30 lb. weight, tup B, flatplate holder B to a level of 220 ft-lb.

There shall be no sign of flaking or disintegration of pipe when immersed in anhydrous acetone for 20 minutes as per ASTM D2152. Pipe shall show no evidence of cracking or splitting when pipe is flattened in a circumferential orientation between two flat plates to 60% of the original diameter. Each pipe shall pass a factory air test of 3.5 psi as described in ASTM F794.

Pipe shall be furnished free from any voids and hollows not associated with the closed profile design. Pipe shall be free from cracks, holes, foreign inclusions, etc. Pipe shall be manufactured in lengths of 13 ft. Pipe shall have a uniform inside and outside diameter along its length. Pipe color shall be white. Physical attributes of the pipe shall be as uniform as commercially practical. Each PVC closed profile wall pipe length and fitting shall be clearly marked with the following information: manufacturer's name, pipe size, cell classification ASTM F-794 designation, Uni-bell Plastic Pipe Association designation, and pipe stiffness "PS-46 PSI".

**K. Protection of Plastic Pipe Materials:**

Before, during, and after installation, plastic pipe and fittings shall be protected from exposure to sunlight and any environment that would result in damage to or deterioration of the material. Pipe shall be covered with opaque plastic film. Solvents, solvent compounds, lubricants and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life.

**L. Centrifugally Cast Fiberglass Pipe:**

Pipe shall be manufactured in accordance with ASTM D3262 and tested in accordance with ASTM D3262 for stiffness. Pipe shall be suitable for direct bury as indicated on the drawings.

Pipe Stiffness minimum shall be SN46.

**2.04 ENCASEMENT PIPE**

Encasement pipe shall be uncoated steel pipe conforming to the Standards of AWWA C200. Minimum wall thickness shall be as follows:

<u>Diameter Encasement Pipe</u>	<u>Roadway</u>	<u>Railroad</u>
14"	0.216"	0.250"
16"	0.250"	0.281"
20"	0.250"	0.344"
24"	0.250"	0.375"
30"	0.312"	0.469"

36"	0.375"	0.531"
42"	0.438"	0.625"
48"	0.500"	0.688"

For special installations see drawings for wall thickness.

#### Casing Spacers

Used to facilitate the installation of a carrier pipe inside a casing pipe. Manufactured of steel. Circular steel shell segments shall be secured with stainless bolts, nuts and washers. Risers shall be of proper height to provide the center restrained method of installation. 1/8" thick gasket material strips shall be placed under each steel spacer segment to provide a dielectric insulator between the spacer and the carrier pipe. Spacers shall be installed to a minimum of one behind the bell end and one in the center of each 18ft. or 20ft. joint of carrier pipe, or in accordance with manufacturers recommendations, based on approved submittals

### 2.05 WATER PIPE FITTINGS

Pipe fittings shall be cast iron or ductile iron designed and manufactured as per ANSI A21.10. Fittings shall be designed for an internal pressure of 250 psi.

Class 350 ductile iron compact fittings may be furnished as an alternate to Class 250 iron fittings. Ductile iron material used for Class 350 iron fittings shall conform to ASTM A536, minimum grade 70-50-05. Thickness of Class 350 iron fittings shall be equal to, or exceed, 350 psi working pressure rated ductile iron pipe thickness. Radii or curvatures shall conform to ANSI A21.10. The Class 350 ductile iron compact fittings shall conform to ANSI A21.53 and all applicable provisions of this Article.

Lining for all pipe fittings shall be cement mortar with a seal coat of bituminous material, all in accordance with ANSI A21.4.

All pipe fittings shall have mechanical joints in accordance with ANSI A21.11.

### 2.06 Mechanical Joint Restraints

#### A. Wedge Action Retainer Gland

Mechanical joint follower gland, with gripping wedge restraint system, incorporated into the design of the gland. Proper torque of the wedges is regulated by twist off nuts. Used to restrain valves, fittings and hydrants to ductile iron pipe. Rated restraint,  
3" through 16" = 350psi  
18" through 36" = 250psi

Retaining glands shall be the Meg-A-Lug, series 1100 by EBAA Iron Inc., Stargrip, series 3000 by Star Pipe Products or One Lock by Sigma Corporation.

#### B. Mechanical Joint Tee with Restrained Swivel Branch

*(For Hydrant Installations)*

Used for restraining mechanical joint gate valves directly to the tee.

C. Mechanical Joint Swivel by Mechanical Joint Solid Adapter

May be used to provide a restrained connection between the outlet side of mechanical joint gate valves and the mechanical joint connection on fire hydrants. The length of the adapter shall be as short as possible for the conditions.

Tees with swivel branch and swivel by solid adapters shall be cement lined with a seal coat of bituminous material in accordance with ANSI A21.4.

Swivel tees and adapters shall be manufactured by Tyler Pipe Co., or approved equal.

2.07 VALVES AND TAPPING SLEEVES

A. Valves 12-Inches and Smaller:

Valves 12-Inches and smaller shall be resilient wedge gate valves conforming to the applicable requirements of AWWA C509 Standards, with a working pressure of 250 psi, O-ring sealing, 2" square operating nut, open left and mechanical joint ends. Valves manufactured of ductile iron shall meet all applicable requirements of AWWA C515 with a working pressure of 250 psi. All interior and exterior ferrous metal surfaces shall be coated with a minimum of 8 mils of fusion-bonded coating meeting the requirements of AWWA C550. Valves may be used in sizes 4" thru 12". Valves shall be manufactured by Mueller, American Flow Control, M&H, Clow, Kennedy, or U.S. Pipe.

Resilient wedge gate valves shall be warranted for 10 years from date of purchase against defective material or workmanship.

B. Valves 16-Inch and 20-Inch:

16-Inch and 20-inch valves shall be vertical resilient wedge gate valves conforming to the applicable requirements of AWWA C509 Standards with a working pressure of 250 psi, and manufactured of ductile iron. Valves shall have O-ring sealing, 2" square operating nut, open left, and mechanical joint ends. All interior and exterior ferrous metal surfaces shall be coated with a minimum of 8 mils of fusion-bonded epoxy paint meeting the requirements of AWWA C550. Valves shall be manufactured by American Flow Control, Clow, or U.S. Pipe.

C. Valves 24-Inches and larger:

Valves 24 inches and larger shall be butterfly valves, designed for underground or buried service applications. Butterfly valves shall conform fully with AWWA Standard C504 for class 150B, with a working pressure of 150 psi, unless specified otherwise in the special provisions, or on the plans. The valves shall have a 2" square operating nut - open left, horizontal shafts manufactured of stainless steel and the body manufactured of cast iron with mechanical joint ends.

Valve operator/actuator shall be for buried service and of the traveling nut or link and lever design with AWWA stops capable of absorbing 450 foot-pounds of input torque. Valves shall have resilient seating and the seat ring shall be manufactured of stainless steel. All internal parts shall be factory coated with a minimum of 8 mils of liquid or fusion bonded epoxy, AWWA approved for potable water. External iron surfaces shall be coated with a minimum of two coats of black asphaltic paint. Valves shall be manufactured by Mueller, Pratt or M&H.

D. Surge Relief, Pressure Reducing and Altitude Valves:

Surge relief, pressure reducing and altitude valves shall be flanged iron globe body; fully bronze mounted; external pilot operated with free floating piston operated without springs, diaphragm, or levers; single seat with seat bore equal to size of valve. Valves shall be manufactured in accordance with AWWA C506.

All surfaces of iron castings shall be coated with a minimum of two coats of a serviceable grade of asphaltic base metal paint.

The valve design shall be such that repairs and internal dismantling of the main valve may be done without removing the valve from the water main.

Valve working and surge pressures will be shown on the drawings or designated in the "Special Conditions" of the contract specifications. Valves shall be Ross or approved equal.

E. Check Valves:

Check valves shall be swing type with iron body and flanged ends, meeting all requirements of AWWA C508. Valves to have an iron disc with bronze disc ring and seat ring and lever and weight controlled. All internal iron surfaces of the valve shall be coated with a minimum of 8 mils of fusion bonded or liquid epoxy, approved for potable water.

An approved alternate check valve is the series 2100, as manufactured by American Flow Control, approved in sizes 4" through 12".

F. Air Relief Valves for Water Lines:

Air relief valves shall be dual operation valves that allows air to escape when the pipeline is being filled and air to enter when the pipeline is being emptied. Valves to be iron with screwed inlet connections and having a 150 psi working pressure. Valves to be Crispin Universal Air Valves Model No. UL20, with 1/4" orifice, or approved equal.

H. Air Relief Valves for Sewer Force Mains:

Air relief valves for sewer force mains shall allow air to escape when the pipeline is being filled and when air accumulates during operation. Valves to be iron with screwed inlet connection and having a 150 psi working pressure. Valves to be Crispin Pressure Sewer Valves Model No. US20B, with backflush attachment and 1/4" orifice, or approved equal.

I. Main Line Sewer Valves:

All valves used for 16-inch and smaller sanitary sewer lines shall conform to the specifications for water line valves of the same size.

#### J. Tapping Sleeve/Saddle and Valve:

Tapping Sleeves shall be manufactured of ductile iron, cast iron or stainless steel. Flanged faced and drilled per ANSI B 16.1, with standard tapping flange counterbore per MSS SP-60. Tapping sleeves shall meet minimum working pressure requirements of 200 psi. Should manufacturers pressure design standards exceed this requirement, they shall be supplied. All tapping sleeves shall include a test plug.

Approved tapping sleeves are as follows:

<u>Brand/Model</u>	<u>Size Range Approved</u>
US Pipe, Model T-28	Approved in all available sizes
Romac SST III with Ductile Iron or Stainless Steel Flange	Approved in sizes 4"x 4" thru 24"x 12"
Mueller H-304 with Ductile Iron or Stainless Steel Flange	Approved in sizes 4"x 4" thru 24"x 12"
PowerSeal Model 3490MJ	Approved in sizes 4"x 4" thru 24"x 16"
*American Flow Control, Series 1004	Approved in sizes 16"x 16" thru 36"x 24"
*Mueller H-615	Approved in sizes 16"x 16" thru 36"x 24"

\*Approved for outlet sizes of 16" and larger only.

Tapping Saddles shall be ductile iron, flanged faced and drilled per ANSI B 16.1 with standard tapping flange counterbore per MSS SP-60. Straps to be manufactured of alloy steel. Tapping saddles shall meet minimum working pressure requirements of 250psi. All tapping saddles shall include a test plug. Tapping saddle shall be manufactured by U.S. Pipe, and is approved in all available sizes.

Tapping Valves shall be mechanical joint x tapping flange. The flanged end shall have a raised face to match counterbore in tapping sleeve outlet per MSS SP-60. Tapping valves shall also conform to the specifications and approved brands as outlined in the valves section 2.07, paragraph's A & B.

#### 2.08 FIRE HYDRANTS

Hydrants shall have a compression type main valve, open left, closing with line pressure. Nominal main valve opening shall be 4 ½", with bronze to bronze seating, and 6" mechanical joint elbow. Hydrants shall have one 4 ½" steamer nozzle, and two 2 ½" hose nozzles all with national standard threads. Other hydrant features shall be a breakable safety stem coupling and breakable safety flange design, dry top design, a weather cap/shield around the operating nut, and a 4 ½ foot bury body. The interior of the hydrant base and all ferrous metals of the lower valve plate assembly shall be coated with a minimum of 8 mils of fusion bonded or brush applied liquid epoxy. The liquid epoxy shall be AWWA approved for potable water. All other interior and exterior ferrous metal surfaces shall receive one coat of primer paint in accordance with AWWA standards. The exterior of the lower barrel shall receive one finish coat of black asphaltic varnish. The exterior of the upper barrel shall receive one finish coat of green enamel equivalent to RUST-O-LEUM Forest Green #1282. The caps and bonnet shall receive one finish coat of white

enamel equivalent to RUST-O-LEUM High Gloss White #2766. The bonnet shall then receive one coat of Axon Aerospace ALERT bright white light reflective coating #1460.

The Contractor shall apply an additional full coat of Axon Aerospace ALERT bright white light reflective coating #1460 to the bonnet, and any necessary coating of the RUST-O-LEUM Forest Green #1282 and the RUST-O-LEUM Gloss White #2766 to restore the hydrant finish to a new condition. This function shall take place after installation of the hydrant and prior to final acceptance by the City.

Hydrants shall comply with AWWA Standard C-502, including compliance to the maximum permissible loss of head for hydrants. Hydrants shall be Clow Medallion (with the increased boss thickness in the hydrant shoe), Mueller Centurion, American Mark-73, Kennedy K-81A, M&H Model 929, or U.S. Pipe Metropolitan 250.

The Contractor shall furnish different bury hydrants or provide suitable extensions at locations shown on the plans or designated by the Engineer. The Contractor may use Fire Hydrant Gradelok as a hydrant restrainer. Payment for the different bury or extension will be made as outlined in Sub-Article 3.07 D.(2) of these specifications.

## 2.09 WATER LATERALS AND APPURTENANCES

This section includes copper tubing, valves (corporations and curb stops) and meter setting appurtenances, which conform to AWWA C800-89. Copper tubing shall be manufactured in accordance with ASTM B88 (Seamless Copper Water Tube). Corporations, curb stops and fittings shall be manufactured in accordance with ASTM B62 (Standard Specifications for Composition Bronze or Ounce Metal Castings), and having an identification of Copper Alloy UNS No.C83600.

### A. WATER LATERALS:

Water Laterals shall be Type K soft copper tubing, conforming to ASTM B-88-62  
Couplings for tubing shall have compression connections as manufactured by Mueller, Ford or A.Y. McDonald.

### B. CORPORATION STOPS (Ball Type)

CC thread inlet x compression outlet

Approved

	Mueller	Ford	A.Y. McDonald
3/4"	B-25008	FB1000-3	4701B-22 or BT
1"	B-25008	FB1000-4	4701B-22 or BT
1-1/2"	B-25008	FB1000-6	4701B-22 or BT
2"	B-25008	FB1000-7	4701B-22 or BT

### C. CURB STOPS (Ball Type)(Blow-off)

Compression inlet x FIP outlet

Approved

	Mueller	Ford	A.Y. McDonald
3/4"	B-25172	B41-333	6102W-22 or WT
1"	B-25172	B41-444	6102W-22 or WT
1-1/2"	B-25172	B41-666	6102W-22 or WT
2"	B-25172	B41-777	6102W-22 or WT

**D. METER SETTERS (Domestic)**

5/8"x 3/4", 3/4" & 1"

Vertical inlet and outlet meter setters with padlock wing.

(With compression connections for copper tubing)

Approved

	Mueller	Ford	A.Y. McDonald
5/8"x 3/4"	B-2474	VB82W-44-33-G	32-207-WX22-33
3/4"	B-2474	VB83W-44-33G	32-307-WX22-33
1"	B-2474	VB84W-44-33-G	32-410-WX22-44

1-1/2" & 2" (For flanged meters)

To include flanged angle ball valve on inlet and flanged angle check valve on outlet.

By-pass to include ball type cutoff valve with padlock wing.

1-1/2" dimensions – 12" high x 13-1/4" length.

2" dimensions – 12" high x 17-1/4" length.

Approved

	Mueller	Ford	A.Y. McDonald
1-1/2"	B-2423-2-01	VBH76-12B-11-66	20B-612-WDFF665
2"	B-2423-2-01	VBH76-12B-11-77	20B-712-WDFF775

**METER SETTERS (Irrigation)**

5/8" x 3/4", 3/4" & 1"

Horizontal inlet and outlet setters with padlock wing

(With compression connections for copper tubing)

Approved

	Mueller	Ford	A.Y. McDonald
5/8"x 3/4"	B-2470	VB72-7W-44-33G	22-207-WX22-33
3/4"	B-2470	VB73-8W-44-33G	21-207-WX22-33
1"	B-2470	VB74-10W-44-33G	32-410-WX22-44

1-1/2" & 2" (For flanged meters)

To include flanged angle ball valve on inlet and flanged angle check valve on outlet.

By-pass to include ball type cutoff valve with padlock wing.

1-1/2" dimensions – 12" high x 13-1/4" length.

2" dimensions – 12" high x 17-1/4" length.

Approved

	Mueller	Ford	A.Y. McDonald
1-1/2"	B-2423-2-01	VBH76-12B-11-66	20B-612WDFF665
2"	B-2423-2-01	VBH76-12B-11-77	20B-712WDFF775

#### E. SERVICE SADDLES

Service saddles shall be double strap design, manufactured of bronze, with corporation thread outlet. Approved saddles are the Smith Blair 323, Romac 202B, Ford 202B and Mueller.

#### F. METER BOXES

For 5/8" x 3/4" And 3/4" Meters

Box manufactured of polyethylene plastic using the structural foam method of construction. The cover shall be two piece, lock down, manufactured of cast iron. Meter box and top shall be the MB-1 as manufactured by Southeastern Distributors, or approved equal.

For 1" Meters

Box manufactured of polyethylene plastic using the structural foam method of construction. The cover shall be two piece, lock down, manufactured of cast iron. Meter box and top shall be the MB-2 as manufactured by Southeastern Distributors, or approved equal.

For 1 1/2" And 2" Meters

24" wide x 36" long x 30" deep. Box and top manufactured of fiberglass reinforced polymer concrete and fiberglass reinforced polymer. Top shall include 6" x 9" cast iron reader door (centered), two 5/8"x 4" lifting slots and a recessed knockout, a 7" diameter x 11/16" deep counter bore with a 2" diameter hole centered in the counter bore to accommodate the radio transmitter module (ITRON Model 40W-1 PIT ERT). Design loads meet ASTM C857 A-16 Standards. Box and cover shall be the WA04-2436-30C as manufactured by CDR Systems Corporation, or approved equal.

#### 2.10 MANHOLES

Manholes shall conform to the details and designations as shown and noted on the manhole Standards contained in the City's "Roadway and Utility Standard Drawings" manual. Precast concrete manholes shall be manufactured in accordance with ASTM C478 "Precast Reinforced Concrete Manhole Sections".

Joint surfaces for joints between bases, risers, and cones shall be manufactured to the joint surface design and tolerance requirements on ASTM C361. The maximum slope of the vertical surface shall be 2 degrees. The maximum annular space at the base of the joint shall be 0.10-inch. The minimum height of the joint shall be 2 1/2-inches.

Joint sealing material between manhole sections shall be rubber gasketed joints or butyl rubber. Rubber gasketed joints shall conform to ASTM C443 "Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets". Butyl rubber sealants shall conform to Federal Specifications SS-S-210A, AASHTO M-198, Type B-Butyl Rubber with a maximum of 1%



volatile matter and suitable for application at temperatures between 10 and 100 degrees F. If butyl rubber joints are used, the surface of the joint receiving the butyl rubber shall be coated with an adhesive coating to assure that a seal is established between the rubber and the concrete.

Precast base sections shall have the base slab cast monolithically with the walls. Manhole inverts may be cast monolithically with the base section or be formed and cast into an existing base section. Openings shall provide clearances for pipe projecting a minimum of 2-inches inside the manhole. The trough shall be formed and finished to provide a consistent slope from the pipe inlet to the outlet. The minimum fall across the manhole shall be 1-inch. The channel cross sectional profile shall be consistent and uniform from invert to invert. The bench shall be sloped to provide draining to the invert. No depressions, high spots, voids, chips, or fractures will be permitted along the trough.

Manhole steps shall be provided in bases, risers, cones, and transitions. Steps are to be 16-inches on center. Secure steps to the wall with a compression fit in tapered holes or cast in place. Steps shall not be vibrated or driven into freshly cast concrete or grouted in place. Steps shall be No. PS-1-PM, as manufactured by M. A. Industries, Inc. or approved equal. Step pullout strength shall be a minimum of 2000 lb. when tested according to ASTM C497.

Flexible connectors between precast manhole structures and pipe shall conform to ASTM C923. All sections shall have lifting holes.

## 2.11 CONCRETE AND MASONRY

### A. Concrete:

Concrete shall conform to the requirements of Section 1000 of the NCDOT's 2002 Standard Specifications.

The classes of concrete for the different types of poured in place concrete work shall be as follows:

<u>Type of Work</u>	<u>Class of Concrete</u>
Structural	A, Air-Entrained
Flat Work, Curb & Gutter, and Miscellaneous Concrete Work	B, Air-Entrained
Reaction Blocking, Trench Concrete, and Manhole Foundations	B, Non-Air-Entrained

### B. Masonry:

All masonry materials shall conform to the requirements of Section 1040 of the NCDOT's 2002 Standard Specifications.

## 2.12 STONE AGGREGATE

All stone aggregate shall conform to the requirements of Section 1005 of the NCDOT's 2002 Standard Specifications. Aggregate gradation shall conform to Table 1005-1 of the Standard Specifications.

## 2.13 BITUMINOUS CONCRETE PLANT MIXES

All bituminous concrete plant mixes shall conform to the requirements of the applicable Sections of Division 6 of the NCDOT's 2002 Standard Specifications.

## 2.14 IRON CASTINGS

Manhole rings and covers, valve boxes, grates, and other miscellaneous castings shall conform to the applicable details and dimensions shown in the City's "Roadway & Utility Standard Drawings" manual, these specifications and the following provisions.

Iron castings shall be boldly filleted at angles, and the arrises shall be sharp and perfect. No sharp, unfilleted angles or corners will be permitted. They shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes, and other defects affecting their strength and value for the service intended. All castings shall be sand blasted or otherwise effectively cleaned of scale and sand so as to present a smooth, clean and uniform surface. Cover and frame surfaces shall be machined flat to provide for uniform seating.

Gray iron castings shall meet the requirements of ASTM A48 for Class 30 iron.

## 2.15 SEWER LATERALS AND APPURTENANCES

### A. Sewer Laterals:

Sewer laterals shall be service weight cast-iron soil pipe, coated, conforming to ASTM A74 or Schedule 40 PVC/DWV 1120 pipe, conforming to ASTM D1785, with a pressure rating of 220 psi. PVC pipe joints shall be solvent cemented in accordance with ASTM D2855.

The Contractor's attention is called to the fact that when schedule 40 PVC/DWV pipe is used for sewer laterals, the one-way clean-out and associated vertical stack shall be PVC/DWV as specified herein.

### B. Sewer Lateral Wye Branches:

Sewer lateral wye branches shall be the same type material as the sewer main, and shall conform to the applicable sewer pipe specifications contained in this Section.

### C. Sewer Lateral Cleanouts:

Sewer lateral cleanouts shall be schedule 40 PVC 1120 pipe with schedule 40 PVC/DWV Long Sweep ¼ bend and cast soil pipe double hub coupling.

### D. Sewer Cut-Ins:

Cut-Ins shall be cast iron GENCO, Model D, Type K; DFW flexible saddle; or approved equal. Cut-ins shall be used where new sewer laterals are connected to existing sewer mains.

CONSTRUCTION OF WATER LINES  
**SECTION 3**

**3.01 GENERAL DESCRIPTION**

The work covered by this section consists of those operations that are basic and unique to the construction of water lines. Operations that are special for the construction of a particular water line are covered under the "Special Conditions". Those basic operations which are common to the construction of both water and sewer lines are covered under Section 5 of these specifications, "Work Common to Water and Sewer Line Construction".

All work described herein is to be performed in accordance with the requirements in the drawings and the provisions of these specifications.

**3.02 TRENCH AND BACKFILL**

**A. Description:**

The work covered by this Article consists of excavating, backfilling, compacting, and cleaning up a trench for water lines.

**B. Construction Requirements:**

The trench shall be excavated to the alignment shown in the drawings or to the centerline staked in the field. The depth of the trench shall conform to the profile shown in the drawings. Trench width at the top of the pipe shall not exceed the nominal diameter of the pipe plus two feet without approval of the Engineer.

Trench sheeting, shoring, or bracing shall be used where shown in the drawings, specified in the Special Conditions, or directed by the Engineer to protect the utility under construction, to allow construction to be performed according to drawings and specifications, or to prevent damage to property. The Contractor shall adhere to all OSHA requirements concerning trench sheeting, shoring, or bracing during all trench excavation. Where trench sheeting, shoring, or bracing is used, the trench width may be increased accordingly.

Trench protection shall be left in place at least until the pipe has been laid and backfilled to a point two feet above the pipe. The Engineer may direct that trench sheeting be left in place.

Trench excavation shall proceed in advance of pipe installation for only as far as the Engineer will permit.

Depressions in the stone bedding for the pipe bells shall be provided at each joint but shall be no larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. The trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.

Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil. Care shall be taken to prevent damage to the existing installation.

Where the trench subgrade is found to be unstable or to include unsuitable materials, it shall be undercut as described in Article 3.03, "Trench Stabilization".

Trench excavation is classified to include rock only. All other material is unclassified and shall be excavated under the provisions of this Article. Excavated material shall be placed in a manner that will not obstruct the work, endanger the work or otherwise cause a threat to the welfare of the public. The trench shall be kept dewatered during the excavating, pipe laying and backfilling stages of the work. Discharge from any dewatering pumps shall be conducted to natural drainage channels, storm sewers, or an approved reservoir.

All backfill material shall be free from cinders, ashes, vegetable or organic material, boulders, rocks or stones, frozen soil, or other material that, in the opinion of the Engineer, is unsuitable. When the type of backfill material is not indicated in the drawings or is not specified, the excavated material may be used, provided that such material consists of loam, clay, sand, gravel, or other materials that, in the opinion of the Engineer, are suitable for backfilling. The conditions under which the Engineer will authorize payment for replacement backfill material are set forth in Article 5.03, "Replacement Backfill Material".

Backfill material around the pipe and to a point 1 foot above the barrel of the pipe shall be selected materials that can be compacted to form a dense envelope about the pipe. All backfill material from the trench bottom to the top shall be compacted to a density of 95% of Standard Proctor Density as described under Article 1.05, "General Material and Compaction Testing Requirements". The Contractor shall be responsible for all settlement over trenches that may occur prior to the completion of his contract and for a period of twelve months thereafter.

Particular attention will be directed to inspection of the material envelope around pipe designed as a flexible conduit.

All excess trench excavation shall be disposed of in an approved waste area. Any deficiency in backfill material shall be provided by the Contractor except in cases where payment is authorized for replacement backfill material. The ground surface shall be left in a condition such that erosion control measures can be immediately carried out.

C. Method of Measurement:

The quantity of trench and backfill to be paid for will be the actual number of linear feet of accepted ditch, measured along the axis of the installed pipe.

D. Basis of Payment:

The quantities of trench and backfill, measured as provided in Sub-Article 3.02 C., will be paid for at the contract unit price per linear foot for the various water trenches shown below.

The above price and payment will be full compensation for all work covered by this Article, including but not limited to excavating a trench for water pipe and

appurtenances; sheeting, shoring, or bracing the trench; preparing the trench bottom; backfilling and compacting the trench; disposing of excess excavation; and restoring the area to its previous condition.

Payment will be made under:

Trench & Backfill for \_\_\_\_ Inch Water Lines LF

### 3.03 TRENCH STABILIZATION

#### A. Description:

The work covered by this Article consists of undercutting and stabilizing trench bottoms with crushed stone.

#### B. Construction Requirements:

Where the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed to a minimum of 3-inches, or to the depth ordered by the Engineer, and replaced under the directions of the Engineer with No. 67 stone. The locations for trench undercutting, and the amount of stone to be used by the Contractor shall, in all cases, be designated by the Engineer.

#### C. Method of Measurement:

The quantity of trench stabilization stone to be paid for will be the actual number of tons of No. 67 stone which has been incorporated into the completed and accepted work. The stone will be measured by being weighed in trucks on approved platform scales or by other approved weighing devices. No deduction will be made for any moisture contained in the stone at the time of weighing.

The Contractor shall exercise care in transporting, any stockpiling, and placing the stabilization stone. Waste of stone shall be kept within reasonable limits as determined by the Engineer. The City reserves the right to deduct for payment stone that has been wasted by the Contractor through improper procedures or negligence.

#### D. Basis of Payment:

The quantity of trench stabilization stone, measured as provided in Sub-Article 3.03 C., will be paid for at the contract unit price per ton for "No. 67 Stone for Trench Stabilization". No measurement or direct payment will be made for undercutting trench bottoms, as the cost of undercutting shall be included in the price per ton of No. 67 stone for trench stabilization.

The above price and payment will be full compensation for all work covered by this Article including but not limited to undercutting trench bottoms; furnishing, hauling, any stockpiling, placing, and tamping when required No. 67 stone for trench stabilization.

### 3.04 INSTALLATION OF WATER PIPE

#### A. Description:

The work covered by this Article consists of furnishing and installing ductile iron water pipe, in an open cut trench, at the locations shown on the drawings. The pipe shall be installed in accordance with all applicable specifications of ANSI/AWWA C600 and the following specifications.

#### B. Handling and Storage:

All pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding in order to avoid shock or damage. Under no circumstances shall the pipe be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground.

Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior lining of the pipe.

Pipe shall not be stacked higher than the limits specified in ANSI/AWWA C600.

Gaskets for pipe joints shall be stored in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

#### C. Alignment and Grade:

The water mains shall be laid and maintained to lines and grades established by the drawings with fittings, valves, and hydrants at the required locations unless otherwise approved by the Engineer. Valve-operating stems shall be oriented in a manner to allow proper operation. Hydrants shall be installed plumb.

When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with approval of the Engineer, to provide clearance as required by state regulations or as deemed necessary by the Engineer to prevent future damage or contamination of either structure.

#### D. Pipe Installation:

Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water-main materials and protective coatings and linings. Under no circumstances shall water-main materials be dropped or dumped into the trench. The trench shall be dewatered prior to installation of the pipe.

All pipe fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.

All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid.

Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

At time when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.

The bell ends of the pipe shall face the direction of laying unless directed otherwise by the Engineer; for lines on an appreciable slope, the Engineer may require that the bell ends face upgrade.

#### E. Joint Assembly:

Push-on joints and mechanical joints shall be assembled as outlined under 3.4.1 and 3.4.2 of the ANSI/AWWA C600 Specifications.

When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed that shown below. The maximum deflection shown is for a 20-ft. length of pipe with push-on joints. The pipe sizes and maximum deflections are shown in inches.

<u>Pipe Size</u>	<u>Maximum Deflection</u>
4 thru 12	21
14 thru 36	12
42 and 48	8
54	6

Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe or cement-mortar lining. Pipe may be cut using an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, milling wheel saw, or oxyacetylene torch. Cut ends and rough edges shall be ground smooth, and for push-on joint connections, the end shall be beveled.

#### F. Method of Measurement:

The quantity of ductile iron water pipe to be paid for will be the actual number of linear feet of pipe that has been satisfactorily installed and accepted. A City Survey Crew or an Inspector will make measurements, and such measurements shall be along the centerline of the pipe through all fittings, valves, and appurtenances. The Contractor shall cooperate with the City Survey Crews and Inspectors to obtain correct profiles, locations, and

measurements of installed pipe and appurtenances. This cooperation shall include setting reference stakes at all backfilled appurtenances (tees, reducers, end of pipes, etc.) for centerline station measurements by the Survey Crews.

G. Basis of Payment:

The quantity of ductile iron pipe, measured as provided in Sub-Article 3.04 F., will be paid for at the contract unit price per linear foot for "Furnish and Install \_\_\_\_ Inch Ductile Iron Water Pipe".

The above price and payment will be full compensation for all work covered by this Article including but not limited to furnishing, hauling, and installing all pipe; making all joint connections; and testing, chlorinating, and placing the line in service.

3.05 BORE FOR WATER LINE

A. Description:

The work covered by this Article consists of boring water line crossings for concrete driveways or other obstacles, at the locations shown on the drawings.

B. Construction Requirements:

The bores shall be of adequate size to accommodate the water pipe without causing an excessive void around the pipe. The face of the bore shall be a distance of five feet from either side of the edge of the driveway, or obstacle, unless otherwise approved by the Engineer.

The Contractor will be required to take all reasonable precautions to prevent damage to the adjacent roadbed and the above driveway, or obstacle when installing water line pipe. Voids around the water line pipe shall be kept to an absolute minimum. The Inspector shall have the authority to order boring discontinued where in his opinion damage to the adjacent roadbed, driveway, or obstacle appears likely. The Contractor shall take necessary measures to protect the roadbed, driveway, or obstacle before again commencing operations. Where excessive voids develop, such corrective action as is directed by the Engineer shall be taken.

C. Method of Measurement:

The quantity of water line pipe bore to be paid for will be the actual number of linear feet of water line pipe bore that has been acceptably bored using the boring method. Measurement will be made from face of bore to face of bore. Water pipe will be paid for separately at the contract unit price per linear foot for, "Furnish & Install \_\_\_\_ Inch D.I. Water Pipe".

D. Basis of Payment:

The quantity of water line pipe bore, measured as provided in Sub-Article 3.05 C. will be paid for at the contract unit price per linear foot for "Bore \_\_\_\_ Inch Water Line".



The above price and payment will be full compensation for all work covered by this Article including, but not limited to bore pit excavation and backfill, boring and any incidentals necessary to complete the work.

### 3.06 VALVE AND FITTING INSTALLATION

#### A. Description:

The work covered by this Article consists of furnishing and installing valves and pipe fittings, in an open cut trench, at the locations shown on the drawings.

#### B. Construction Requirements:

All valves 20-inches and smaller shall be resilient seat/wedge gate valves. All valves 24 inches and larger shall be butterfly valves. Valves shall conform to Sub-Article 2.07 A., 2.07 B., or 2.07 C. of these specifications.

Prior to installation, valves shall be inspected for direction of opening, freedom of operation, tightness of pressure-containing bolting, cleanliness of valve ports and especially seating surfaces, handling damage, and cracks. Defective valves shall be corrected or held for inspection by the Engineer.

Valves, fittings, plugs, and caps shall be set and joined to the pipe in the manner specified in Sub-Articles 3.04 D. and 3.04 E. for cleaning, laying, and joining pipe, except that valves 16-inches and larger shall be provided with special support, such as crushed stone, concrete or masonry pads, or sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve.

Fittings may be either cast iron or ductile iron as specified in Section 2 of these specifications.

Unless designated otherwise on the drawings or in the Special Conditions, a valve box with necessary extension shall be provided for every valve. The valve box shall not transmit shock or stress to the valve and shall be centered over the operating nut. The box cover shall be installed flush with the surface of the finished area, or as may be directed by the Engineer.

Valve boxes shall conform to City of Greensboro Standard No. 102 in the City's "Roadway & Utility Standard Drawings" manual.

In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

All dead ends on new mains shall be closed with plugs or caps that are suitably restrained to prevent blowing off under test pressure. If a blow-off valve precedes the plug or cap, it too shall be restrained against blowing off. All dead ends shall be equipped with suitable blow-off facilities. Blow-off facilities for main sizes 2-inch thru 8-inch shall conform to City of Greensboro Standard No. 108 in the City's "Roadway & Utility Standard Drawings" manual. For main sizes larger than 8-inch, fire hydrants or blow-off assemblies, 4-inch and larger, shall be installed in accordance with approved construction drawings. Blow-offs and associated drainage lines shall not be connected to any type

sewer or submerged in any stream or installed in any manner that would permit back siphonage into the City's water distribution system. Blow-offs 4-inch and larger shall require a flap valve to be installed at the end of the drainage line.

All plugs, caps, tees, and bends, unless otherwise specified, shall be provided with concrete reaction blocking, Meg-A-Lug type restraint systems (see 2.06 mechanical joint restraints) or suitably restrained joints as indicated on the drawings or directed by the Engineer. Concrete reaction blocking shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that shown on the drawings or directed by the Engineer. The blocking shall, unless otherwise shown or directed, be so located as to contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair. Where concrete must be reinforced, the Contractor shall furnish such reinforcing as is required. No direct payment will be made for concrete reaction blocking and reinforcement for pipe sizes up to and including 16-inches in diameter. A bid item for concrete reaction blocking will be listed in the Itemized Proposal for pipe sizes over 16-inches in diameter.

All hydrant valves shall be restrained to the main line with a Swivel Hydrant Tee and rotating split gland. All branch line valves shall be restrained to the main line where a valve may blow off during testing or where future extension of the branch line is possible. The branch line valve shall be restrained with restraint devices other than concrete blocking.

C. Method of Measurement:

(1) Valves: The quantity of valves to be paid for will be the actual number of valves, with box or manhole, which have been furnished, satisfactorily installed, and accepted.

(2) Fittings: The quantity of fittings to be paid for will be the actual number of fittings that have been furnished, satisfactorily installed, and accepted. Each fitting will be paid for by fitting weight. The weight of each type of fitting will be taken from the fitting tables shown in the Cast Iron Research Association Handbook. These weights will be used for payment regardless of material; cast iron, ductile iron, or ductile iron with a thinner wall; that the fitting has been manufactured from. The weights to be used for payment will be fitting weight only, no additional weight will be allowed for glands, bolts, and accessories.

D. Basis of Payment:

(1) Valves: The quantity of valves, measured as provided in Sub-Article 3.06 C.(1), will be paid for at the contract unit price each for "Furnish and Install \_\_\_\_ Inch Valve with (box/manhole)".

The above price and payment will be full compensation for all work covered by the applicable provisions of this Article including but not limited to furnishing and installing the gate valve, valve box with necessary extensions or manhole, any restraining devices, and any incidentals necessary to complete the work.

(2) Fittings: The quantity of fittings, measured as provided in Sub-Article 3.06 C.(2), will be paid for at the contract unit price per pound for "Furnish and Install Iron Fittings".

The above price and payment will be full compensation for all work covered by the applicable provisions of this Article including but not limited to furnishing and installing the fittings, glands, bolts, and accessories; concrete reaction blocking and any reinforcement for fitting sizes up to and including 16-inches in diameter; and any incidentals necessary to complete the work.

### 3.07 TAPPING SLEEVE AND VALVE INSTALLATION

#### A. Description:

The work covered by this Article consists of excavating an area of sufficient size to tap an existing water line and set a valve, furnishing and installing a tapping sleeve and valve, performing the water line tap, and backfilling and compacting the area. The locations and sizes will be designated on the drawings or directed by the Engineer.

#### B. Construction Requirements:

The Contractor shall furnish and install the tapping sleeve and valve conforming to Section 2.07(j). The Contractor will do the tapping of the existing main according to manufacturer's specifications.

The Contractor shall excavate an area of sufficient size and depth, conforming to OSHA requirements, to accommodate the operations of tapping the existing line and setting the valve.

The Contractor shall furnish and install a valve box with the necessary extensions, backfill and compact the excavated area. The backfill material and compaction shall meet all applicable requirements of Article 3.02 of these specifications.

The Contractor shall perform a 150 psi pressure test, or a different pressure as required by the Engineer, on the tapping sleeve and valve prior to tapping the existing water main. This pressure test will be performed using the test plug provided with the tapping sleeve.

#### C. Method of Measurement:

The quantity of tapping sleeves and valves to be paid for will be the actual number of tapping sleeves and valves furnished and satisfactorily installed by the Contractor.

#### D. Basis of Payment:

The quantity of tapping sleeves and valves, measured as provided in Sub-Article 3.07 C., will be paid for at the contract unit price each for "Tapping Sleeve and Valve, \_\_\_ Inch X \_\_\_ Inch", which price and payment will be full compensation for the Contractor to excavate, furnish and install the appropriate tapping sleeve and valve and perform the water line tap, furnish and install a valve vault or valve box with necessary extensions, backfilling and compacting the excavated area.

### 3.08 HYDRANT INSTALLATION

#### A. General:

The work covered by this Article consists of furnishing and installing fire hydrants, in an open-cut trench, at the locations shown on the drawings.

All fire hydrant connections shall be made on the water main by using a mechanical joint tee with the restrained swivel branch outlet, as manufactured by Tyler Pipe, or approved equal. This provides a restrained connection between the tee and the mechanical joint valve.

Beyond the valve, the hydrant can be installed by one of the following methods.

1. Connect the fire hydrant to the outlet side of the mechanical joint valve with a mechanical joint swivel by mechanical joint solid adapter, as manufactured by Tyler Pipe, or approved equal. This method provides positive restraint when short distances between the valve and the hydrant are required.
2. Connect the fire hydrant to the outlet side of the mechanical joint valve with a proper length of ductile iron pipe, using wedge type mechanical joint retainer glands (MEG-A-LUG Series 1100, or approved equal) on the connections between the valve and the hydrant.
3. The bowl, or elbow of each hydrant shall be well braced against a sufficient area of unexcavated earth at the end of the trench with poured in place concrete. The area of bearing on the hydrant and on the unexcavated earth in each instance shall be that shown on the drawings, or as directed by the Engineer. The contractor shall exercise extreme caution when placing concrete against the hydrant bowl / elbow, in order to prevent covering the drain ports of the hydrant with concrete.

#### B. Construction Requirements:

Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating-nut and cap-nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage, and cracks. Defective hydrants shall be corrected or held for inspection by the Engineer.

All hydrants shall be set by one of the two following procedures:

(1) In streets or areas where paving is proposed in the near future, the Contractor will be given line and grade stakes for hydrant setting. It shall be mandatory for the Contractor to preserve these stakes for the Engineer to use to verify that the hydrant has been set correctly. After the hydrant setting has been verified by the Engineer, the Contractor will not be required to alter the hydrant line or grade without extra compensation.

(2) In streets or areas where paving is not anticipated in the near future, hydrants shall be set according to the directions of the Engineer. In these locations hydrants shall generally be set in a manner to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.

Any dirt or foreign matter shall be removed from all hydrants before they are set.

Hydrants set in soil that is impervious shall have a drainage pit two feet in diameter and two feet deep excavated below the bowl. This pit shall be filled with No. 67 stone to a point six inches above the drain port. Hydrants set in soil that is pervious shall have No. 67 stone placed around the bowl to a point six inches above the drain port and a minimum of one foot laterally in all directions.

All hydrants shall be set plumb and shall have their nozzles parallel with the existing or future curb, with the pumper nozzle facing the curb.

At the locations designated on the drawings, or where directed by the Engineer, the Contractor shall furnish hydrants with a barrel that will allow a bury depth greater than the standard four and one-half foot bury hydrant. A maximum of one (1) barrel extension per hydrant shall be permitted.

C. Method of Measurement:

- (1) The quantity of hydrants to be paid for will be the actual number of hydrants that have been furnished, installed, and accepted.
- (2) The quantity of additional hydrant barrel length to be paid for, that is used for extra bury depth, will be the actual number of linear feet of additional hydrant barrel that has been furnished, installed, and accepted.

D. Basis of Payment:

- (1) The quantity of hydrants, measured as provided in Sub-Article 3.08 C.(1), will be paid for at the contract unit price each for "Furnish and Install Four and One-Half Foot Bury Hydrant."
- (2) The quantity of additional hydrant barrel length, measured as provided in Sub-Article 3.08 C.(2), will be paid for at the contract unit price per linear foot for "Extra Depth for Hydrants."

The above prices and payments will be full compensation for all work covered by this Article, including but not limited to excavation; furnishing and installing hydrants and additional hydrant barrel lengths; excavating drain pits; furnishing and placing concrete blocking; furnishing and installing any tie rods, clamps, or other methods of restraining joints; backfill and compaction; repainting; and any incidentals necessary to complete the work. The No. 67 stone placed around the hydrant bowl for drainage will be paid for separately under the bid item for "No. 67 Stone for Trench Stabilization".

3.09 BLOW-OFFS

A. Description:

The work covered by this Article consists of furnishing and installing water main blow-offs for main sizes 2-inches thru 8-inches. Blow-offs for main sizes over 8-inches and blow-offs that have special requirements will be covered in the Special Conditions.

#### B. Construction Requirements:

All dead ends on new mains shall be closed with plugs or caps that are suitably restrained to prevent blowing off under test pressure. If a blow-off valve precedes the plug or cap, it too shall be restrained against blowing off. All dead ends shall be equipped with suitable blow-off facilities. Blow-off facilities for main sizes 2-inch thru 8-inch shall conform to City of Greensboro Standard No. 108 in the City's "Roadway & Utility Standard Drawings" manual. For main sizes larger than 8-inch, fire hydrants or blow-off assemblies, 4-inch and larger, shall be installed in accordance with approved construction drawings. Blow-offs and associated drainage lines shall not be connected to any type sewer or submerged in any stream or installed in any manner that would permit back siphonage into the City's water distribution system. Blow-offs 4-inch and larger shall require a flap valve to be installed at the end of the drainage line.

The Contractor shall tap the plug or cap at the end of the water main; furnish and install a threaded connection; trench and backfill for the blow-off line; furnish and install the necessary copper tubing for the blow-off line, a meter box, and a curb stop inside the meter box.

The threaded portion of the connection shall be wrapped with Teflon tape before being installed in the plug or cap.

#### C. Method of Measurement:

(1) Trench and Backfill: The quantity of trench and backfill to be paid for will be the actual number of linear feet of accepted ditch, measured horizontally along the ditch from the plug or cap to the meter box.

(2) Corporation Stops: The quantity of corporation stops to be paid for will be the actual number of corporation stops that have been satisfactorily installed and accepted for blow-offs.

(3) Copper Tubing: The quantity of copper tubing to be paid for will be the actual number of linear feet of copper tubing, measured along the centerline of the tubing, that has been satisfactorily installed and accepted for blow-offs.

(4) Meter Boxes: The quantity of meter boxes to be paid for will be the actual number of meter boxes that have been satisfactorily installed and accepted for blow-offs.

(5) Curb Stops: The quantity of curb stops to be paid for will be the actual number of curb stops that have been satisfactorily installed and accepted for blow-offs.

No measurement or direct payment will be made for tapping of the plug or cap as the cost of the tapping shall be included in the various bid items.

#### D. Basis of Payment:

(1) Trench and Backfill: The quantity of trench and backfill, measured as provided in Sub-Article 3.09 C.(1), will be paid for at the contract unit price per linear foot for "Trench and Backfill for Water Laterals".

(2) Corporation Stops: The quantity of corporation stops, measured as provided in Sub-Article 3.09 C.(2), will be paid for at the contract unit price each for "Furnish and Install \_\_\_\_\_ Inch Corporation Stop".

(3) Copper Tubing: The quantity of copper tubing, measured as provided in Sub-Article 3.09 C.(3), will be paid for at the contract unit price per linear foot for "Furnish and Install \_\_\_\_\_ Inch Copper Tubing".

(4) Meter Boxes: The quantity of meter boxes, measured as provided in Sub-Article 3.09 C.(4), will be paid for at the contract unit price each for "Furnish and Install Meter Box for Blow-off".

(5) Curb Stops: The quantity of curb stops, measured as provided in Sub-Article 3.09 C.(5), will be paid for at the contract unit price each for "Furnish and Install \_\_\_\_\_ Inch Curb Stop".

The above prices and payments will be full compensation for all work covered by this Article, including but not limited to trench and backfill; tapping the plug or cap; furnishing and installing the corporation stop, copper tubing, meter box, and curb stop; and any incidentals necessary to complete the work.

Payment will be made under:

Trench and Backfill for Water Laterals	LF	
Furnish and Install _____ Inch Corporation Stop	EA	
Furnish and Install _____ Inch Copper Tubing	LF	
Furnish and Install Meter Box for Blow-off		EA
Furnish and Install _____ Inch Curb Stop	EA	

### 3.10 WATER SERVICE LATERALS

#### A. Description:

The work covered by this Article consists of furnishing and installing water service laterals in an open cut trench or in unlined bores.

#### B. Construction Requirements:

Water service laterals shall be installed in accordance with detail drawing No. 101 in the City's "Roadway & Utility Standard Drawings" manual and these specifications.

The water main shall be thoroughly flushed, using a flow velocity sufficient to scour the pipe interior, before any water laterals are installed.

The Contractor shall trench and backfill or bore for the water lateral; tap the water main; furnish and install a corporation stop, the necessary copper tubing, a meter setter, and a meter box.

The threaded portion of the corporation stop shall be wrapped with Teflon tape before the stop is installed in the water main.

Each meter setter shall be flushed briefly immediately after it has been installed.

The trench and backfill operations shall be performed in accordance with all applicable provisions of Article 3.02 of these specifications.

Bores shall be of adequate size to accommodate the lateral without causing an excessive void around the pipe. The face of the bore shall be a distance of five feet from the edge of pavement or back of curb on either side of the roadway unless approval to the contrary is given by the Engineer.

Taps shall only be made after the water main is under pressure. No taps on dry mains will be allowed unless specific authorization is obtained from the Engineer. Taps shall be on an angle 45 degrees to a perpendicular through the centerline of the pipe.

The maximum size of direct taps in water mains shall be as follows:

<u>Main Size</u>	<u>Tap Size</u>
4"	3/4"
6"	1"
8"	1"
12"	1 1/4"
16" and larger	2"

The Contractor shall be equipped to make the above size taps on water mains.

C. Method of Measurement:

(1) Trench and Backfill: The quantity of trench and backfill to be paid for will be the actual number of linear feet of accepted ditch, measured horizontally along the ditch from the water main to the meter box.

(2) Bores: The quantity of bore to be paid for will be the actual number of linear feet of accepted bore, measured horizontally along the bore from face of bore to face of bore.

(3) Corporation Stops: The quantity of corporation stops to be paid for will be the actual number of corporation stops that have been satisfactorily installed and accepted.

(4) Copper Tubing: The quantity of copper tubing to be paid for will be the actual number of linear feet of copper tubing, measured along the centerline of the tubing, that has been satisfactorily installed and accepted.

(5) Meter Setter with Boxes: The quantity of meter setters with associated meter boxes to be paid for will be the actual number of setters with associated boxes that have been satisfactorily installed and accepted.



No measurement or direct payment will be made for tapping of the water main as the cost of the tapping shall be included in the various bid items.

D. Basis of Payment:

(1) Trench and Backfill: The quantity of trench and backfill, measured as provided in Sub-Article 3.10 C.(1), will be paid for at the contract unit price per linear foot for "Trench and Backfill for Water Laterals".

Payment will only be made for that portion of trench occupied exclusively by a water lateral, as payment for trench and backfill for sewer laterals shall cover both water and sewer laterals where the laterals jointly occupy the trench.

(2) Bores: The quantity of bore, measured as provided in Sub-Article 3.10 C.(2), will be paid for at the contract unit price per linear foot for "Bore for Water Laterals".

Where the water lateral jointly occupies a bore with a sewer lateral, payment for the sewer lateral bore shall cover both, as no separate payment will be made for the water lateral bore.

(3) Corporation Stops: The quantity of corporation stops, measured as provided in Sub-Article 3.10 C.(3), will be paid for at the contract unit price each for "Furnish and Install \_\_\_\_\_ Inch Corporation Stop".

(4) Copper Tubing: The quantity of copper tubing, measured as provided in Sub-Article 3.10 C.(4), will be paid for at the contract unit price per linear foot for "Furnish and Install \_\_\_\_\_ Inch Copper Tubing".

(5) Meter Setter with Box: The quantity of meter setters with associated meter boxes, measured as provided in Sub-Article 3.10 C.(5), will be paid for at the contract unit price each for "Furnish and Install \_\_\_\_\_ Inch Meter Setter and Box".

The above prices and payments will be full compensation for all work covered by this Article, including but not limited to trench and backfill or bore; tapping the water main; furnishing and installing the corporation stop, copper tubing, meter setter with associated meter box; and any incidentals necessary to complete the work.

Payment will be made under:

Trench and Backfill for Water Laterals	LF
Bore for Water Laterals	LF
Furnish and Install _____ Inch Corporation Stop	EA
Furnish and Install _____ Inch Copper Tubing	LF
Furnish and Install _____ Inch Meter Setter and Box	EA

### 3.11 PRESSURE TESTING AND CHLORINATION OF WATER LINES

#### A. Pressure Testing:

The Contractor shall furnish all labor and equipment necessary to perform the pressure tests. The pressure test shall be performed by the Contractor and observed by the Engineer.

Unless modified in the project special provisions, the test pressure shall be 150 psi as measured at the lowest elevation of the line. The duration of the test shall be two hours. The 150 psi test pressure shall be maintained during the two hours by use of a by-pass pumping system.

Allowable leakage per 1,000 linear feet of pipe per two hours shall be as follows:

Note: If pressure testing of the water line fails due to one or more leaking joints, those joints shall be cut out or removed from the pipe installation and closure shall be made with suitable lengths of ductile iron pipe and mechanical joint solid sleeves. Bell joint repair clamps are not permitted.

<u>Pipe Size (Inches)</u>	<u>Allowable Leakage (Gallons)</u>
4	0.73
6	1.11
8	1.47
10	1.84
12	2.21
14	2.57
16	2.94
20	3.68
24	4.41
30	5.52
36	6.62
48	8.83

The following prerequisite conditions shall have been met before any pressure testing begins:

- (1) All hydrants are properly located, operable, plumb, and at correct elevation.
- (2) All valves are properly located, operable, and at correct elevation, with valve boxes or manholes centered over wrench nuts, and top of box or manhole at correct elevation.
- (3) The water line or lines are properly vented where entrapped air is a consideration.

B. Chlorination:

All water lines or appurtenances added to or replaced in the City of Greensboro water system shall be properly chlorinated before being placed in service. The Contractor under the supervision of the Engineer shall perform the chlorination.

Any pipe subjected to contaminating materials shall be treated as directed by the engineer. Should such treatment fail to cleanse the pipe, the Contractor shall replace the pipe at no cost to the City.

The Contractor shall perform the chlorination of a completed line in the following manner:

(1) Taps will be made at the control valve located in the upstream end of the line and at all extremities of the line. These taps shall be located in such a manner as to allow high-test hypochlorite (HTH) solution to be introduced into all parts of the line.

(2) A water solution containing HTH (65%) available chlorine shall be introduced into the line by regulated pumping at the control-valve tap. The solution shall contain a concentration of HTH that will produce a uniform concentration of 100 ppm total chlorine immediately after the introduction of the solution into the line has been completed.

The following quantities of 65% HTH compound per 1000 feet of line is required to produce a solution concentration of 100 ppm total chlorine as stated above:

<u>Pipe Size (Inches)</u>	<u>65% HTH (Pounds per 1000 feet of line)</u>
4	0.84
6	1.88
8	3.35
10	5.70
12	7.53
14	10.26
16	13.43
20	20.92
24	30.14
30	47.00
36	67.85
48	120.60

The HTH solution shall be circulated in the line by opening the control valve and systematically manipulating hydrants and taps at the line extremities. The HTH solution must be pumped into the line at a constant rate for each discharge rate in order that a uniform concentration will be maintained in the line.

Water laterals shall be sterilized by the Contractor using methods acceptable to the Engineer. The Contractor shall bear the same responsibility for water laterals as he bears for water mains and appurtenances, including any costs for corrective measures needed to comply with the bacteriological requirements.

The HTH Solution shall remain in the lines for a minimum of 24 hours. If directed by the Engineer the HTH solution shall remain in the lines longer than 24 hours. At the end of this period the free residual chlorine shall be a minimum of 10 ppm or the lines shall be rechlorinated.

The Contractor shall exercise extreme caution at all times in order to prevent the HTH Solution from entering the City of Greensboro's existing water system.

#### RESIDUAL CHLORINE DISPOSAL

The Contractor shall be responsible for either reducing the amount of residual chlorine in the water through chemical dechlorination apparatus or by discharging the super-chlorinated water directly into the sanitary sewer.

##### Direct Discharge to Sanitary Sewer

The Contractor shall provide necessary pipe, hose or fittings to connect from blow-off's or hydrant outlets to sanitary sewer manholes. Hoses, piping or fittings shall be restrained at the entry of the manhole(s) to insure a continuous air-gap between the hose/pipe outlets and the sewer flow levels. Unless specifically approved by the engineer in writing, the maximum flow discharge to the sanitary sewer shall not exceed 200 gallons per minute. A metering device that measures in gallons, or gallons per minute with a control valve shall be used to regulate the flow ( Pollard P743 Fire Hydrant Meter), or equal. The Contractor shall monitor the next three downstream manholes to verify that the sanitary sewer main(s) are not being surcharged and that the sewer capacity has not been exceeded. The Engineer may require additional downstream manholes to be monitored if critical flow conditions exist. The Engineer may also reduce the amount of discharge if conditions in the downstream manholes warrant this reduction.

##### Dechlorination of Discharge Water

In lieu of discharging the super-chlorinated water directly to the sanitary sewer system, the Contractor may elect to dechlorinate the water by use of apparatus that injects or mixes EPA approved chemicals with the water to neutralize the chlorine before it is released to the ground, streams or storm sewer systems. Residual chlorine levels shall be reduced and maintained to a maximum of 2.0 parts per million (2.0mg/l). The Contractor shall test the discharge at 15 minute intervals to insure that acceptable levels of neutralization are maintained. Discharge shall be stopped if chlorine levels exceed 2.0 parts per million.

Units shall be the Pollard LPD250 Diffuser and Dechlorination System, the H2O Neutralizer, as manufactured by Measurement Technologies, Inc., or approved equal. All procedures shall be in accordance with manufacturers recommendations and as approved by the Engineer.

All costs incurred with these processes are to be considered incidental to the disinfection and flushing procedures as outlined in 3.11 Pressure Testing and Chlorination of Water Lines

C. Flushing and Bacteriological Sampling:

The Contractor may proceed with flushing of the lines after the 24-hour or longer period outlined above, provided the free residual chlorine analysis is satisfactory. The flushing shall continue until a check shows that the lines contain only the normal chlorine residual.

The Engineer shall collect water samples for bacteriological analysis 24 hours after flushing of the lines is completed. The Contractor shall furnish any reasonable amount of assistance that may be required by the Engineer to secure these samples.

Bacteriological test results will be available 24 hours after the water samples have been submitted to the City of Greensboro's Water Treatment Testing Laboratory.

If test results are unsatisfactory, the Contractor shall immediately rechlorinate the lines and proceed with such measures as are necessary to secure sterile lines. All laterals shall be rechlorinated during this process.

At the satisfactory completion of the bacteriological requirements, the lines shall be placed into service under the supervision of the Engineer. All valves shall be fully opened, and the Engineer shall report each valve placed into service to the Utilities Maintenance Division where a permanent record will be kept of the number of valve stem turns.

D. Temporary Gate Valves:

The Contractor shall furnish and install a temporary gate valve as shown on plans, or, where in the opinion of the Engineer a gate valve is needed to properly chlorinate, test, and flush a new line.

After the temporary gate valve has served its purpose, the Contractor shall remove the valve and tie the line together. The removed gate valve shall become the property of the Contractor and may be used at a permanent location providing it is in satisfactory condition.

All labor, equipment, and materials with the exception of the gate valve, necessary to install, remove, and tie the line together will be paid for on a force account basis.

CONSTRUCTION OF SEWER LINES  
SECTION 4

4.01 GENERAL DESCRIPTION

The work covered by this section consists of those operations that are basic and unique to the construction of sewer lines. Operations that are special for the construction of a particular sewer line are covered under the "Special Conditions". Those basic operations which are common to the construction of both water and sewer lines are covered under Section 5 of these Specifications, "Work Common to Water and Sewer Line Construction".

All work described herein is to be performed in accordance with the requirements in the drawings and the provisions of these specifications.

4.02 TRENCH AND BACKFILL

A. Description:

The work covered by this Article consists of excavating, preparing, backfilling, compacting, and cleaning up a trench for sewer lines.

B. Construction Requirements:

The trench shall be excavated to the centerline alignment shown in the drawings. The alignment will be referenced in the field by offset stakes set by City Survey Crews. The depth of the trench shall conform to the profile shown in the drawings. The depth will also be referenced in the field by the same offset stakes. The Contractor shall use these reference stakes to determine the depth of cut that will be furnished to the Contractor by the Engineer in the form of cut sheets. Trench width at the top of the pipe shall not exceed the nominal diameter of the pipe plus two feet without approval of the Engineer. Trench walls shall not be undercut.

Trench sheeting, shoring, or bracing shall be used where shown in the drawings, specified in the Special Conditions, or directed by the Engineer to protect the utility under construction, to allow construction to be performed according to drawings and specifications, or to prevent damage to property. The Contractor shall adhere to all OSHA requirements concerning trench sheeting, shoring, or bracing during all trench excavation. Where trench sheeting, shoring, or bracing is used, the trench width may be increased accordingly. Trench protection shall be left in place at least until the pipe has been laid and backfilled to a point two feet above the pipe. The removal of sheeting shall be done in such a manner as to minimize the loss of friction between the backfill and trench walls. Where directed by the Engineer the sheeting shall be cut off and left in place. Sheeting shall not be braced against the pipe or in any manner that will allow concentrated loads or horizontal thrusts to be transmitted to the pipe. Whenever a movable steel box is used in place of sheeting, care shall be taken to protect the integrity of the pipe bedding and to prevent the pipe from moving when the steel box is moved. The pipe must be secured to prevent longitudinal movement.

Trench excavation is classified to include rock only. All other material is unclassified and shall be excavated under the provisions of this Article. Excavated material shall be placed in a manner that will not obstruct the work, endanger the work or otherwise cause a threat to the welfare of the public.

Trench excavation shall be carried out in such a manner as to conform to the line and grade shown in the drawings; excavation shall proceed in advance of pipe laying only as far as the Engineer will permit. The trench shall be braced and drained in order that workmen may work therein safely and efficiently. Discharge from pumps shall be led to natural drainage channels, to drains, or to storm sewers. Erosion control shall be maintained when discharging water into natural drainage channels.

Trench width may vary with the depth of trench and nature of the excavated material, but in any case shall be of sufficient width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly. In no case shall the width be more than 24 inches greater than the nominal diameter of the pipe without approval of the Engineer.

Pipe foundation shall at all times be such that the pipe rests uniformly on the trench bottom. Bell holes shall be dug. No pipe will be accepted where the bells of the pipe are supporting the weight of the pipe. Should the trench pass over a water or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil. Care shall be taken to prevent damage to the existing installation. Any part of the trench excavated below grade shall be corrected with approved, compacted material before the pipe is laid. Where the subgrade is unstable or water is present in quantities sufficient to make uniform bedding of the pipe impossible, the Contractor shall stabilize the trench bottom with stabilization stone, as directed by the Engineer, and as described in Article 4.03 "Trench Stabilization and Pipe Bedding".

There are a number of different trench conditions that may be encountered on a project. The Proposal provides for crushed stone for trench stabilization and pipe bedding as shown on the plans or detailed in the special provisions. Provision is also made in the Proposal for replacement backfill material. Wherever, in the opinion of the Engineer, the existing soil is suitable for bedding purposes, it shall be used; where the existing soil is not suitable, the Engineer may direct that crushed stone or replacement backfill material be used for bedding. Trench conditions will be the basis for deciding how to properly bed the pipe.

Backfill material to a point one (1) foot above the pipe shall be select material. If this material is not available on the site, the Engineer may direct that replacement backfill material be brought in or that crushed stone be used for backfill. Trench conditions will be the basis for deciding how to backfill the pipe to the one-foot point.

The following provisions shall apply for the bedding and backfilling of concrete, vitrified clay, ductile iron, and ABS or PVC Composite Pipe. Backfill material to a point one (1) foot above the barrel of the pipe shall be selected materials free of large stones or clods larger than 1 ½ inches in diameter and shall be placed and compacted as follows:

(1) Subgrade to Springline of Pipe:

Material shall be hand placed and hand tamped under the lower haunches of the pipe and then brought to the springline of the pipe with either hand or power tamps. Care shall be taken to avoid damage to the pipe in the tamping operation. This backfill shall be tamped to a minimum density of 90% of Standard Proctor Density.

(2) Springline to One Foot Above Pipe:

Backfill material in this zone shall be compacted to a minimum density of 85% of Standard Proctor Density. Care shall be exercised in tamping directly above the pipe to prevent damage to the pipe.

(3) One Foot Above Pipe to the Surface of the Ground:

Backfill material shall be placed and compacted or consolidated to produce a uniformly dense backfill load on the pipe and to minimize voids in the material. Rocks and boulders shall be excluded from backfill for at least 2 feet above the top of the pipe, and no stone larger than 4 inches in its largest dimension, in any case, shall be used in the backfilling.

The following provisions shall apply for the installation of PVC, PVC Open Profile, and PVC Closed Profile sewer pipe:

PVC sewer pipe shall be installed in accordance with ASTM D2321.

Class I, II, or III "Embedment Material" as outlined in ASTM D2321 shall be used for the installation of PVC sewer pipe.

The Contractor shall furnish Class III or better "Embedment Material", at no additional cost to the City, at trench locations where Class IV materials are encountered. The Contractor shall also dispose of excess Class IV materials at no additional cost to the City.

At trench locations where Class V materials are encountered the Contractor shall furnish Class III or better "Embedment Material" as directed by the Engineer. The Contractor will receive compensation for furnishing Class III or better "Embedment Material" at trench locations where Class V materials are encountered under the items of crushed stone for trench stabilization and pipe bedding or replacement backfill material as provided for in the Proposal.

Deflection tests shall be performed on 100% of the PVC pipe installed. Maximum allowable deflection shall be 5% at any point. Deflection shall be measured by the Contractor with a "Go/No Go" gauge furnished by the Engineer. The gauge shall be hand pulled through the pipe by means of a strong cord or cable furnished by the Contractor. Any section of pipe not meeting the 5% maximum deflection requirement shall be excavated, backfilled, recompact and retested until the pipe section meets the 5% deflection requirement.

Within roadway right-of-ways or in locations where wheel loads are likely to be applied to the pipe, the backfill material shall be compacted to a density of 95% of Standard Proctor Density from a point one foot above the pipe to the surface of the ground.

All density tests shall be conducted at the direction of the Engineer by qualified technicians in accordance with Article 1.05 "General Material and Compaction Testing Requirements", and the cost of such tests will be borne by the City, with the provision that after two failing tests in the same location, the Contractor shall be required to submit satisfactory evidence that his ditch compaction meets the specifications. The Contractor



shall be responsible for all settlement over trenches that may occur prior to the completion of his contract and for a period of twelve months thereafter.

Deficiency of backfill material shall be supplied by the Contractor where this deficiency results from any cause other than rejection of unsuitable backfill material (other than rock) by the Engineer. In cases where the Engineer directs, the Contractor shall dispose of unsuitable backfill material and provide suitable backfill material.

The conditions under which the Engineer will authorize payment for replacement backfill material are set forth in Article 5.03, "Replacement Backfill Material".

All trenches shall be completely backfilled at the end of each day's work, unless directed otherwise by the Engineer. No backfilling of frozen material will be allowed.

C. Method of Measurement:

The quantity of trench and backfill to be paid for will be the actual number of linear feet of the various depths of cut of accepted ditch, measured horizontally along the ditch. The various depths of cut shall be computed from the cut sheets using linear mathematical interpolation between stations.

D. Basis of Payment:

The quantities of trench and backfill, measured as provided in Sub-Article 4.02 C., will be paid for at the contract unit price per linear foot for the various sewer trenches shown below.

The above price and payment will be full compensation for all work covered by this Article, including but not limited to excavating a trench for sewer pipe, manholes, and appurtenance sheeting, shoring, or bracing the trench; preparing the trench bottom; backfilling and compacting the trench; disposing of excess excavation; and restoring the area to its previous condition.

Payment will be made under:

Trench and Backfill \_\_\_\_ Foot Cut for \_\_\_\_ Inch Sewer Lines LF

4.03 TRENCH STABILIZATION AND PIPE BEDDING

A. Description:

The work covered by this Article consists of undercutting unstable trench bottoms and replacing the undercut material with stabilization stone. Also covered by this Article is the furnishing and placing crushed stone for pipe bedding.

B. Construction Requirements:

Where the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed to a minimum of 3-inches, or to the depth ordered by the Engineer, and replaced with a foundation and

bedding of crushed stone, suitably graded, and acting as an impervious mat into which the unstable soil or unsuitable material will not penetrate. The depth of crushed stone used for foundation and bedding shall depend upon the severity of the condition of the trench bottom soil or material. The amount of crushed stone to be used by the Contractor shall, in all cases, be designated by the Engineer.

Carefully prepare bedding so that the pipe after installation will be true to line and grade.

Surface grade bedding stone beneath the pipe to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. Densify bedding stone beneath the pipe.

After each pipe has been brought to grade, aligned, and placed in final position, deposit and densify sufficient bedding material under the pipe haunches and on each side of the pipe to hold the pipe in proper position during subsequent pipe jointing, bedding, and backfilling operations. Deposit bedding material uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

C. Method of Measurement:

The quantity of trench stabilization and pipe bedding stone to be paid for will be the actual number of tons of stabilization or bedding stone which has been incorporated into the completed and accepted work. The stone will be measured by being weighed in trucks on approved platform scales or by other approved weighing devices. No deduction will be made for any moisture contained in the stone at the time of weighing.

The Contractor shall exercise care in transporting, any stockpiling, and placing the stabilization or bedding stone. Waste of stone shall be kept within reasonable limits as determined by the Engineer. The City reserves the right to deduct for payment stone that has been wasted by the Contractor through improper procedures or negligence.

D. Basis of Payment:

The quantity of trench stabilization and pipe bedding stone, measured as provided in Sub-Article 4.03 C., will be paid for at the contract unit price per ton for "No. \_\_\_\_ Stone for Trench Stabilization" and "No. \_\_\_\_ Stone for Pipe Bedding". No measurement or direct payment will be made for undercutting trench bottoms, as the cost of undercutting shall be included in the price per ton bid for trench stabilization stone.

The above prices and payments will be full compensation for all work covered by this Article, including but not limited to undercutting trench bottoms; furnishing, hauling, any stockpiling, placing, and tamping when required, of crushed stone used for trench stabilization or pipe bedding.

Payment will be made under:

No. ____ Stone for Trench Stabilization	Ton
No. ____ Stone for Pipe Bedding	Ton

#### 4.04 INSTALLATION OF SEWER PIPE

##### A. Description:

The work covered by this Article consists of furnishing and installing sewer pipe in an open cut trench.

##### B. Construction Requirements:

The Contractor may install either vitrified clay pipe, ABS composite pipe, PVC composite pipe, PVC Open Profile pipe, or PVC Closed Profile pipe where the type of pipe is not designated on the drawings. Where the type of pipe, vitrified clay, ABS or PVC composite, PVC, reinforced concrete, or ductile iron is designated on the drawings the Contractor will be required to install the designated type of pipe.

Pipe installation shall conform to all applicable provisions of ASTM C12 for the installation of vitrified clay pipe, ASTM D2680 Appendix for the installation of ABS and PVC composite pipe, ASTM D2321 for the installation of PVC pipe, ASTM C891 for the installation of concrete pipe, Article 3.04 of these specifications for the installation of ductile iron pipe, and the following requirements.

Protect pipe during handling against impact shocks and free fall. Do not permit lifting hooks to come in contact with premolded joint surfaces.

Handle pipe having premolded joint rings or attached couplings so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material. Care shall be taken to avoid dragging the spigot ring on the ground or allowing it to be damaged by contact with crushed stone or other hard objects.

All pipe shall be examined carefully for soundness and specification compliance immediately before installation. Defective pipe or pipe that does not comply to the specifications shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the pipe.

Clean joint contact surfaces immediately prior to jointing. Use lubricants, primers, adhesives, and methods recommended by the pipe or joint manufacturer when joining the pipe.

Using offset reference stakes set by the approved survey crews, lay all pipe straight between changes in alignment and at uniform grade between changes in grade unless directed otherwise by the Engineer. When jointed in the trench, the pipe shall form a true and smooth line.

Keep trenches dry during pipe laying.

Unless directed otherwise by the Engineer, start pipe laying at the lowest point and install the pipe so that the spigot ends point in the direction of flow.

##### C. Method of Measurement:

The quantity of sewer pipe to be paid for will be the actual number of linear feet of pipe that has been satisfactorily installed and accepted. Measurement for payment will be made horizontally along the centerline of the pipe from centerline of manhole to centerline of manhole.

D. Basis of Payment:

The quantity of sewer pipe, measured as provided in Sub-article 4.04 C., will be paid for at the contract unit price per linear foot for "Furnish and Lay Inch Sanitary Sewer Pipe". The above price and payment will be full compensation for all work covered by this Article including but not limited to furnishing, hauling, and installing all pipe; making all joint connections; and performing all leakage tests.

Payment will be made under:

Furnish and Lay \_\_\_\_ Inch (Type of pipe) Sanitary Sewer Pipe LF

4.05 MANHOLE CONSTRUCTION

A. Description:

The work covered by this Article consists of furnishing and installing precast concrete manhole.

B. Construction Requirements:

Precast concrete manhole construction shall conform to detail drawing No. 200/201/209 or No. 212 in the City's "Roadway & Utility Standard Drawings" manual depending on the size of sewer pipe to be installed and/or the location of the manhole.

All manholes located within roadway right-of-ways or paved areas shall conform to detail drawing No. 205A as manufactured by Vulcan (V1995-95), U.S. Foundry (715 ring and cover with insert and DQ cover). Manhole covers shall have a 1" vent hole in the cover.

All dimensions shall be concentric, and as follows: the frame clear opening shall be 22" ( $\pm 1/16$ "). The cover diameter shall be 23 1/2". The cover seating depth shall be 2". The cover seating width shall be 7/8".

All manholes located on sanitary sewer outfalls shall have watertight manhole ring and covers. Manhole ring and covers shall be the Vulcan 2384-3 or U.S.F. 664 ring and KL cover as manufactured by U.S. Foundry & Manufacturing Corp. Manhole covers shall have a 1" vent hole in the cover. The vent hole shall be filled with a solid rubber manhole lid plug, Style No. 1, as manufactured by Cretex Specialty Products or approved equal.

All dimensions shall be concentric, and as follows: the frame clear opening shall be 22" ( $\pm 1/16$ "). The cover diameter shall be 23 1/2".

The Contractor installing the manhole ring and cover and/or his representative shall be responsible for ensuring these dimensional requirements are met. If the ring and cover do not conform to these dimensions, the Contractor will assume all liability and will remove and replace the ring and cover at no additional cost to the City.

Manholes located outside of roadway right-of-ways shall have no more than two precast concrete grade rings. The cast iron manhole ring and cover assembly shall be anchored directly to the cone section of these manholes. A bitumastic strip shall be provided between the frame and manhole cone section to reduce infiltration.

Manhole inverts shall be constructed with a width and height equal to that of the effluent pipe. Alignment and smoothness of the invert shall be so that a minimum of energy loss occurs in the manhole invert. Manholes with precast inverts may be used. A flexible connector shall be provided for each inlet and the outlet of all manholes.

Where designated on the drawings, or directed by the Engineer, a manhole with a drop connection shall be constructed. The drop connection shall be constructed in accordance with detail drawing No. 202 in the City's "Roadway & Utility Standard Drawings" manual.

C. Method of Measurement:

(1) Manholes: The quantity of manholes to be paid for will be the actual number of manholes that are six feet or less in depth which have been furnished, satisfactorily installed, and accepted.

That portion of the manhole over six feet in depth will be paid for under the contract bid item "Extra Depth for Standard No. \_\_\_\_ Manhole".

(2) Manholes with Drop Connections: The quantity of manholes to be paid for will be the actual number of manholes that are six feet or less in depth with drop connections which have been furnished, satisfactorily installed, and accepted.

That portion of the manhole over six feet in depth will be paid for under the contract bid item "Extra Depth for Standard No. \_\_\_\_ Manhole".

(3) Extra Depth for Manholes: The quantity of extra depth for manholes will be the actual number of vertical feet of manhole over six feet in dimension which has been furnished, satisfactorily installed, and accepted. Manholes will be measured for extra depth from the low point in the invert to the top of the casting ring. Measurement will be made to the nearest one tenth of a foot.

D. Basis of Payment:

(1) Manholes: The quantity of manholes, measured as provided in Sub-Article 4.05 C.(1), will be paid for at the contract unit price each for "Construct Manhole, Standard No. \_\_\_\_".

The above price and payment will be full compensation for all work covered by the applicable provision of this Article including but not limited to excavation, backfilling, and compaction; furnishing and placing No. 67 stone sub-base; furnishing and installing precast concrete manhole with steps and ring and cover; furnishing and installing all flexible connectors, with any necessary hardware for pipe connection; constructing inverts; performing leakage tests; providing and installing vent pipe with screens (Std.

No. 212 only) and any incidentals necessary to complete the work. (Rock excavation and replacement backfill material will be paid for separately under the appropriate bid item.)

(2) Manholes with Drop Connections: The quantity of manholes with drop connections, measured as provided in Sub-Article 4.05 C. (2), will be paid for at the contract price each for "Construct Manhole, Standard No.\_\_\_\_, with Drop Connection, Standard No. 202".

The above price and payment will be full compensation for all work covered by the applicable provisions of this Article including but not limited to excavation, backfilling, and compaction; furnishing and placing No. 67 stone sub-base; furnishing and installing precast concrete manhole with steps and ring and cover; furnishing and installing all flexible connectors, with any necessary hardware for pipe connection; constructing drop connection and inverts; performing leakage tests; and any incidentals necessary to complete the work. (Rock excavation and replacement backfill material will be paid for separately under the appropriate bid item.)

(3) Extra Depth for Manholes: The quantity of extra depth for manholes, measured as provided in Sub-Article 4.05 C. (3), will be paid for at the contract unit price per linear foot for "Extra Depth for Standard No. \_\_\_\_ Manhole".

The above price and payment will be full compensation for all work necessary to furnish and install additional vertical depth over six feet in dimension for precast concrete manholes.

#### 4.06 INSTALLATION OF SEWER PIPE INTO EXISTING MASONRY MANHOLES

The Contractor will be required to install sewer pipe into existing manholes at the locations shown or designated on the drawings. However, all proposed sewer lines that would flow into the existing manhole shall have been installed, tested, and accepted before cutting into the existing manhole and installing the connecting section of sewer pipe.

Unless designated otherwise in the Special Conditions, no direct payment will be made for installing sewer pipe into existing manholes as such work will be considered incidental to other work being paid for under the various bid items in the contract. The work will include but not be limited to controlling the flowing sewage, excavation, cutting into the existing manhole, constructing paved inverts, grouting around the new pipe, constructing pipe plugs, backfilling, cleanup, and any incidentals necessary to complete the installation in a satisfactory manner.

This Article shall not apply to existing precast manholes.

#### 4.07 CORING EXISTING PRECAST MANHOLES

All proposed sanitary sewer mains and laterals that will tie into a precast concrete manhole shall be cored at the elevations shown in the drawings or as designated by the Engineer. The openings through the existing manhole walls shall be cored with a suitable coring machine. An approved watertight flexible coupling shall be used to make the connection between the pipe and manhole.

No direct payment will be made for coring and for furnishing and installing watertight flexible couplings, as such work will be considered incidental to other work being paid for by the various items in the contract.

This Article shall not apply to existing masonry manholes.

#### 4.08 CONVERT EXISTING MANHOLE TO DROP MANHOLE

At the locations shown in the drawings or designated by the Engineer the Contractor shall construct drop connections into existing manholes.

The drop connection shall be constructed in accordance with detail drawing No. 203 in the City's "Roadway & Utility Standard Drawings" manual, and the following provisions.

The proposed openings through existing masonry manhole walls shall be made in a neat and workmanlike manner. Flexible couplings will not be required. Grout around the proposed pipes where they enter the masonry manhole using a suitable grout mixture approved by the Engineer.

The proposed openings through existing precast concrete manhole walls shall be cored with a suitable coring machine. An approved watertight flexible coupling shall be used to make the connection between the pipe and manhole.

Payment for converting the manhole will be made at the contract price each for "Construct Drop Connection Into Existing Manhole".

The above price and payment will be full compensation to construct a drop connection into an existing manhole including but not limited to excavation, backfilling, and compaction; cutting or coring openings through the existing manhole walls; furnishing and installing the watertight flexible couplings or grouting around the proposed pipes where they enter the manhole; constructing the drop connection and inverts as shown on detail drawing No. 203; and any incidentals necessary to complete the work. (Any rock excavation or replacement backfill material will be paid for separately under the appropriate bid item.)

#### 4.09 BRICK MASONRY PIPE PLUGS

At the locations shown in the drawings or designated by the Engineer the Contractor shall construct brick masonry pipe plugs. The pipe plugs shall be constructed in accordance with detail drawing No. 210 in the City's "Roadway & Utility Standard Drawings" manual.

Payment for constructing the pipe plug will be made at the contract price per cubic yard for "Brick Masonry Pipe Plug".

The above price and payment will be full compensation for constructing the pipe plug including but not limited to furnishing and installing all brick masonry and any incidentals necessary to complete the work.

#### 4.10 SEWER LATERALS

##### A. Description:

The work covered by this Article consists of furnishing and installing sewer laterals in an open cut trench or in unlined bores.

#### B. Construction Requirements:

Sewer laterals shall be installed in accordance with detail drawing No. 101 in the City's "Roadway & Utility Standard Drawings" manual and these specifications.

The Contractor shall trench and backfill or bore for the sewer lateral; make the lateral connection to the sewer pipe wye; furnish and install the sewer lateral with plug; furnish and install a one-way clean-out, consisting of a 4" PVC ¼ bend long sweep, with the necessary vertical Schedule 40 PVC/DWV pipe stack. The clean-out plug shall be installed into a cast iron double hub with a leaded joint.

The trench and backfill operations shall be performed in accordance with all applicable provisions of Article 4.02 of these specifications.

Bores shall be of adequate size to accommodate the lateral without causing an excessive void around the pipe. The face of the bore cut shall be a distance of five feet from the edge of pavement or back of curb on either side of the roadway unless the Engineer gives approval to the contrary.

#### C. Method of Measurement:

(1) Trench and Backfill: The quantity of trench and backfill to be paid for will be the actual number of linear feet of accepted ditch, measured horizontally along the ditch from the sewer main to the end of the sewer lateral.

(2) Bores: The quantity of bore to be paid for will be the actual number of linear feet of accepted bore, measured horizontally along the bore from face of bore to face of bore.

(3) Sewer Pipe Laterals: The quantity of sewer pipe for laterals to be paid for will be the actual number of linear feet of pipe, measured along the centerline of the pipe, that has been satisfactorily installed and accepted.

(4) Sewer Pipe Wyes: The quantity of sewer pipe wyes to be paid for will be the actual number of wyes that have been satisfactorily installed and accepted.

(5) One-Way Clean-Outs: The quantity of one-way clean-outs to be paid for will be the actual number of clean-outs that have been satisfactorily installed and accepted. No measurement or direct payment will be made for the vertical PVC/DWV pipe clean-out stack as the cost of the stack shall be included in the various bid items.

No measurement or direct payment will be made for any required plugs as the cost of the plugs shall be included in the various bid items.

#### D. Basis of Payment:

(1) Trench and Backfill: The quantity of trench and backfill, measured as provided in Sub-Article 4.10 C. (1), will be paid for at the contract unit price per linear foot for "Trench and Backfill \_\_\_ Foot to \_\_\_ Foot Cut for Sewer Laterals".

(2) Bores: The quantity of bore, measured as provided in Sub-Article 4.10 C. (2), will be paid for at the contract unit price per linear foot for "Bore for Sewer Laterals".



(3) Sewer Pipe Laterals: The quantity of sewer pipe laterals, measured as provided in Sub-Article 4.10 C. (3), will be paid for at the contract unit price per linear foot for "Furnish and Install \_\_\_\_ Inch Sewer Pipe for Laterals".

(4) Sewer Pipe Wyes: The quantity of sewer pipe wyes, measured as provided in Sub-Article 4.10 C. (4), will be paid for at the contract unit price each for "Furnish and Install Sewer Pipe Wyes for Lateral Connection Complete with Plug".

(5) One-Way Clean-Outs: The quantity of one-way clean-outs, measured as provided in Sub-Article 4.10 C. (5), will be paid for at the contract unit price each for "Furnish and Install \_\_\_\_ Inch PVC One-Way Clean-Out".

The above prices and payments will be full compensation for all work covered by this Article, including but not limited to furnishing and installing the sewer pipe wye; trench and backfill or bore; make the lateral connection to the sewer pipe wye; furnishing and installing the sewer lateral with plug; furnishing and installing the one-way clean-out with the necessary vertical Schedule 40 PVC/DWV pipe stack, cast-iron hub, plug; and any incidentals necessary to complete the work.

Payment will be made under:

Trench and Backfill ____ Cut for Sewer Laterals	LF
Bore for Sewer Laterals	LF
Furnish and Install ____ Inch Sewer Pipe for Laterals	LF
Furnish and Install Sewer Pipe Wyes for Lateral Connection Complete w/Plug	EA
Furnish and Install ____ Inch PVC One-Way Clean-Out	EA

#### 4.11 SEWER FORCE MAINS

##### A. Description:

The work covered by this Article consists of furnishing and installing ductile iron sewer force main pipe, in an open cut trench, at the locations shown on the drawings, and performing the necessary pressure tests.

##### B. Construction Requirements:

The sewer force main installation shall conform to all applicable provisions of these Water Line and Sewer Line Specifications and any Special Conditions provisions. Concrete reaction blocking shall be placed at bends, tees, etc. in accordance with all applicable provisions of Article 3.06 of the Standard Specifications.

The Contractor shall furnish all labor and equipment necessary to perform the pressure tests. The pressure test shall be performed by the Contractor and observed by the Engineer.

Unless modified in the project special provisions, the test pressure shall be 150 psi as measured at the lowest elevation of the line. The duration of the test shall be two hours. The 150 psi test pressure shall be maintained during the two hours by use of a by-pass pumping system. Leakage allowed shall be as outlined in the Water & Sewer section.

The Contractor is advised that excessively large excavations at reaction blocking locations, that require amounts of concrete beyond reason, will result in the pay quantity of concrete being reduced proportionately.

No forming of concrete will be required other than the use of simple sand bag or earth forms.

All force main installations shall include the installation of a 12 inch wide polyethylene film that shall run the entire length and be installed 12 inches above the pipe as per 2.03 - D & E (Ductile Iron Pipe for Sewer Force Mains).

C. Method of Measurement:

Measurement for sewer force main items shall conform to all applicable provisions of these Water Line and Sewer Line Specifications as a water line and any Special Conditions or Provisions.

D. Basis of Payment:

Payment for sewer force main items shall conform to all applicable provisions of these Water Line and Sewer Line Specifications and any Special Conditions provisions.

4.12 VISUAL INSPECTION AND TESTING OF SEWER LINES

A. General:

The Contractor shall furnish all labor and equipment necessary to perform the leakage tests. The leakage test shall be performed by the Contractor and observed by the Engineer. Segments of the line shall be tested after they are completed, backfilled and compacted.

The City will furnish all labor and equipment necessary to perform visual inspection of the pipeline and appurtenances. The Contractor shall furnish any reasonable amount of assistance that may be required by the Engineer to perform the visual inspections. Visual inspection of the pipeline and appurtenances shall be performed during all phases of the work and after they are completed, backfilled and compacted.

All defects in the pipeline and appurtenances shall be corrected by the Contractor at no additional costs to the City.

B. Inspection for Defects:

The pipeline shall be visually inspected from each manhole by use of artificial light, reflecting sunlight, closed circuit television cameras, or other devices for visual inspection. All pipelines shall exhibit a fully circular pattern when viewed from one manhole to the following manhole. If the interior of the pipeline shows poor alignment, displaced or damaged pipe, or any other defect, the defects as designated by the Engineer shall be corrected by the Contractor at no additional cost to the City.

### C. Test for Leakage:

All segments of the sewer line shall be tested for leakage. The standard method of testing pipelines for leakage shall be a low-pressure air test. Only when designated in the Special Conditions or directed by the Engineer will the infiltration or exfiltration leakage test be used in lieu of the low-pressure air test.

The Contractor shall correct all visible leaks in pipes, manholes, and appurtenances.

The City of Greensboro leakage test methods for sewer pipelines are as follows:

#### (1) Low-Pressure Air Test

The test shall conform to the requirements of ASTM C828, Low-Pressure Air Test of Vitrified Clay Pipe Lines.

#### (2) Infiltration Test

Test for leakage may be made by an infiltration test for line segments where the ground water table is above the top of the sewer pipe, if designated in the Special Conditions or directed by the Engineer.

All inlets at the upstream manhole(s) of the line segment to be tested shall be plugged. After flow has stabilized, the infiltration shall be collected by using flow-through plugs, dams, or troughs. Infiltration shall not exceed 50 gallons per inch of nominal pipe diameter per mile of pipe per 24 hours, or an equivalent convenient measure of infiltration as approved by the Engineer.

The Engineer shall determine the length and location of line segments to be tested by infiltration method.

#### (3) Exfiltration Test

Test for leakage may be made by an exfiltration test for line segments where the ground water table is below the bottom of the sewer pipe, if designated in the Special Conditions or directed by the Engineer.

The line segment to be tested shall be plugged and filled with water in such a manner that the maximum hydrostatic head at any point along the line shall not exceed 10 feet of water. All manholes shall be tested. Exfiltration shall not exceed 50 gallons per inch of nominal pipe diameter per mile of pipe per 24 hours, or an equivalent convenient measure of exfiltration as approved by the Engineer.

The Engineer shall determine the length and location of line segments to be tested by exfiltration method.

Where a natural water source is not readily available to use for testing, water from the City water system may be used; proper notification procedures for operating valves and hydrants will be required.

#### 4.13 VACUUM TESTING OF MANHOLES

All sanitary sewer manholes constructed by the Contractor shall be vacuum tested for leakage in the presence of a City Inspector. The vacuum test will not apply to any existing manholes that have been converted to drop manholes by the Contractor.

The Contractor shall furnish all labor, equipment, and any appurtenant items necessary to satisfactorily perform the vacuum test. All testing equipment shall be approved for vacuum testing manholes.

Each manhole shall be tested after assembly and unless directed otherwise by the Engineer prior to backfilling.

All lifting holes shall be plugged with an approved non-shrink grout.

All pipes entering the manhole shall be plugged. The Contractor shall securely brace the plugs in order to keep them from being drawn into the manhole.

The test head shall be placed at the inside of the top of the cone section of the manhole and the seal inflated in accordance with the manufacturer's recommendations.

A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time for the vacuum to drop to 9-inches of mercury shall not be less than that shown in the following table.

<u>Manhole Depth</u>	<u>Diameter of Manhole</u>		
	<u>48" Dia.</u>	<u>60" Dia.</u>	<u>72" Dia.</u>
10 Ft. Or Less	60 Sec.	75 Sec.	90 Sec.
>10 Ft. But <15 Ft.	75 Sec.	90 Sec.	105 Sec.
>15 Ft.	90 Sec.	105 Sec.	120 Sec.

(Times shown are minimum elapsed times for a drop in vacuum of 1-inch of mercury).

If the manhole fails the initial test, necessary repairs shall be made with an approved non-shrink grout while the vacuum is still being drawn. Re-testing shall proceed and continue until a satisfactory test is accomplished.

**WORK COMMON TO WATER AND SEWER LINE CONSTRUCTION**  
**SECTION 5**

**5.01 GENERAL DESCRIPTION**

The work covered by this section consists of those operations which are common to the construction of both water lines and sewer lines. Operations which are special for the construction of a particular water line or sewer line are covered under the "Special Conditions". Those operations which are basic and unique to the construction of water lines are covered under Section 3 of these specifications, "Construction of Water Lines". Those operations which are basic and unique to the construction of sewer lines are covered under Section 4 of these specifications, "Construction of Sewer Lines".

All work described herein is to be performed in accordance with the requirements in the drawings and the provisions of these specifications.

**5.02 ROCK EXCAVATION**

**A. Description:**

The work covered by this Article consists of blasting, excavating, removing and disposing of rock from water and sewer trenches.

Rock, under this Article, is defined as solid, ledge rock in place in a water or sewer trench which, in the opinion of the Engineer, cannot be removed practically without the use of drilling and blasting or special techniques such as drilling and wedging. Excavated boulders or rock fragments with a volume over ½ cubic yard may be classified as rock by the Engineer.

**B. Construction Requirements:**

The Contractor shall obtain a blasting permit from the governing agency, as outlined under Article 6.08 of the "Supplementary Conditions" prior to performing any blasting operations.

The approval of the Engineer shall be obtained before any blasting of rock takes place. The Engineer may fix the hours of blasting if he deems it necessary.

All applicable Federal, State, and Local regulations pertaining to transporting, storing, and using explosives shall be met.

For projects within Greensboro's corporate limits, all explosives on the job site shall be stored in accordance with the provisions of Section 12.6, "Storage of Explosives", of the Greensboro Fire Prevention Code. For projects outside the corporate limits, all explosives on the job site shall be stored in accordance with the provisions of Chapter 19, "Fire Prevention Code", of the North Carolina Building Code, Vol. 5.

The Contractor shall take all necessary precautions to protect life and property while engaged in blasting operations. Where there exists the danger of rock or overburden being thrown by a blast, an approved type of blasting mat shall be used. The Engineer will approve the blasting mat for type of construction but not for adequacy. No blasting will be allowed unless a galvanometer is used to check cap circuits.

The Contractor is required to keep a blasting log containing the following information:

1. Date of shot
2. Time of shot
3. Foreman's name
4. Name of person conducting blasting operation
5. Number and depth of holes
6. Depth of overburden
7. Amount and type of explosive used in each hole
8. Type of caps used
9. Weather conditions

The blasting log shall be kept in an orderly manner and shall be available for inspection by the Engineer.

Rock shall be excavated to the same limits as earth except that the trench shall be excavated 6 inches lower than the barrel of the pipe and 9 inches outside the exterior walls of manholes and structures. The trench bottom shall be brought to the proper grade with select material and compacted to the same density specified for backfill material.

Where, in the opinion of the Engineer, blasting constitutes an unacceptable danger to utilities or property, means other than blasting may be required for removal of rock.

Rock excavated from the trench shall be disposed of in an approved waste area.

C. Method of Measurement:

The quantity of rock excavation to be paid for will be the number of cubic yards of rock measured in a rectangular prism along the vertical centerline of the trench. The maximum width of the prism shall be equal to the nominal diameter of the pipe plus two feet. The height of the prism shall be the average height in feet of the rock profile as measured to the nearest 0.1 foot from a point six inches below the pipe barrel to the top of the rock. The length of the prism shall be the number of linear feet of trench rock measured for payment along the vertical centerline of the trench.

D. Basis of Payment:

The quantity of rock excavation, measured as provided in Sub-Article 5.02 C., will be paid for at the contract unit price per cubic yard for "Rock Excavation in Trench".

The above price and payment will be full compensation for all work covered by this Article, including but not limited to drilling; wedging; matting and blasting; excavating the rock; disposing of excavated rock; and any incidentals necessary to satisfactorily complete the work.

Payment for furnishing, placing, and compacting select material in the trench bottom will be made separately under the appropriate contract bid items.

### 5.03 REPLACEMENT BACKFILL MATERIAL

#### A. Description:

The work covered by this Article consists of disposing of unsuitable excavated material and furnishing, placing, and compacting approved backfill material

#### B. Construction Requirements:

Where, in the opinion of the Engineer, material excavated from the trench is unsuitable to be used as backfill material the Contractor shall provide backfill material that is approved by the Engineer. The Contractor will be compensated for providing the backfill material as described in Subarticle 5.03 D.

Where, in the opinion of the Engineer, material excavated from the trench is a suitable soil type to be used as backfill material but contains excessive moisture the following three conditions shall prevail:

1. The Contractor shall reduce the moisture content of the material to an acceptable level by aerating the material adjacent to the excavated trench. No direct payment will be made for aerating the excavated material as such work will be considered incidental to other work being paid for by the various items in the contract.
2. Where the area available to aerate the excavated material is limited or insufficient, and the moisture content is above optimum for the type of soil, but compaction is attainable with extra compactive effort, the Contractor shall use extra compactive effort in the backfilling operation to obtain a soil density of 95% of Standard Proctor Density. No direct payment will be made for the extra compactive effort as such work will be considered incidental to other work being paid for by the various items in the contract
3. Where the area available to aerate the excavated material is limited or insufficient and the moisture content is above optimum for the type of soil, and satisfactory compaction is determined by the Engineer to be unattainable, the Engineer will authorize the Contractor to provide approved backfill material The Contractor will be compensated for providing the backfill material as described in Subarticle 5.03 D.

Where material suitable for backfilling has acquired excessive moisture after being excavated from the trench, the Contractor will not be compensated for providing approved backfill material.

#### C. Method of Measurement:

The quantity of replacement backfill material to be paid for will be the actual number of cubic yards of compacted material measured in a rectangular prism along the vertical centerline of the trench. The maximum width of the prism shall be equal to the nominal diameter of the pipe plus two feet. The height of the prism shall be the average height in

feet measured to the nearest 0.1 foot from the bottom of the trench to the top of the trench less any pavement replacement structure. The length of the prism shall be the number of linear feet of replacement backfill material measured for payment along the vertical centerline of the trench. The Contractor shall adhere to all OSHA requirements concerning trench sheeting, shoring, or bracing during all trench excavation.

No direct payment will be made for additional cubic yards of compacted material as may be necessary due to OSHA trenching requirements, as such work will be considered incidental to other work being paid for under the various items in the contract. The work will include but not be limited to removing backfill materials, disposing of unsuitable excavated material and furnishing, hauling, placing and compacting approved backfill material, as well as any incidentals necessary to satisfactorily complete the work.

D. Basis of Payment:

The quantity of replacement backfill material, measured as provided in Sub-Article 5.03 C., will be paid for at the contract unit price per cubic yard for "Replacement Backfill Material".

The above price and payment will be full compensation for all work to provide replacement backfill material, including but not limited to removing from the site and disposing of the unsuitable excavated material and furnishing, hauling, placing, and compacting approved backfill material.

5.04 REMOVE AND REPLACE PAVEMENT FOR PIPES AND STRUCTURES

A. Description:

The work covered by this Article consists of replacing a bituminous pavement structure in areas where the Contractor removed pavement for the installation of pipe lines and appurtenances.

B. Construction Requirements:

The pavement replacement structure shall be constructed in accordance with detail drawing No. 107 in the City's "Roadway & Utility Standard Drawings" manual and these specifications. Detail drawing No. 107 is shown on two sheets in the "Roadway & Utility Standard Drawings" manual. Sheet 1 of 2 refers to roadways and Sheet 2 of 2 refers to asphalt driveways.

The Contractor shall trim or saw a neat edge along the pavement to be retained, using methods approved by the Engineer.

The materials and construction methods used for the pavement structure replacement shall meet all requirements of the NCDOT 2002 Standard Specifications.

C. Method of Measurement:

The pavement replacement quantities to be paid for will be computed in square yards using the actual trench width up to a maximum width equal to the nominal diameter of the pipe plus three feet. If, in the opinion of the Engineer, conditions beyond the



Contractor's control require additional pavement replacement, a trench width greater than the nominal diameter of the pipe plus three feet will be used to compute pavement replacement quantities.

D. Basis of Payment:

The quantity of pavement replacement, measured as provided in Sub-Article 5.04 C., will be paid for at the contract unit price per square yard for "Remove and Replace Roadway Pavement" or "Remove and Replace Asphalt Driveway."

The above price and payment will be full compensation for all work covered by this Article including but not limited to removing and disposing of the existing pavement; trimming or sawing a neat edge along the pavement to be retained; furnishing, hauling, placing, and compacting the bituminous materials; and any incidentals necessary to complete the work. The ABC stone will be paid for separately under the bid item for "Incidental ABC Stone Base".

5.05 REMOVE AND REPLACE CONCRETE FLATWORK

A. Description:

The work covered by this Article consists of replacing concrete sidewalks, driveways, and miscellaneous slabs that have been removed by the Contractor for the installation of pipe lines and appurtenances.

B. Construction Requirements:

The concrete flatwork replacement shall be constructed in accordance with all applicable provisions of Section 848 of the NCDOT 2002 Standard Specifications and the following provisions.

The Contractor will be required to furnish a neat edge along the concrete pavement retained by sawing a neat line approximately two inches deep, with a concrete saw, before breaking the adjacent concrete pavement away.

The concrete replacement shall be constructed in accordance with the details shown in the drawings or as directed by the Engineer.

Concrete forms shall be constructed to shape, line, and dimension as indicated in the drawings or directed by the Engineer. Forms shall be braced and tied together to prevent displacement during the concrete pouring and finishing operations.

The Contractor shall provide a finish on the replacement concrete that matches the adjacent concrete retained.

C. Method of Measurement:

The concrete flatwork replacement quantities to be paid for will be computed in square yards using the actual trench width up to a maximum width equal to the nominal diameter of the pipe plus three feet. If, in the opinion of the Engineer conditions beyond the Contractor's control require additional flatwork replacement, a trench width greater than

the nominal diameter of the pipe plus three feet will be used to compute flatwork replacement quantities.

D. Basis of Payment:

The quantity of concrete flatwork replacement, measured as provided in Sub-Article 5.05 C., will be paid for at the contract price per square yard for "Remove and Replace \_\_\_\_ Inch Concrete Flatwork".

The above price and payment will be full compensation for all work covered by this Article including but not limited to removing and disposing of the existing concrete flatwork; sawing a neat edge along concrete to be retained; constructing forms; furnishing, hauling, placing, compacting, and finishing concrete; constructing expansion and control joints; and any incidentals necessary to complete the work.

5.06 REMOVE AND REPLACE CONCRETE CURB AND GUTTER

At the locations shown on the drawings or designated by the Engineer the Contractor shall remove the existing concrete curb and gutter necessary for the installation of pipe lines. The removed concrete curb and gutter shall be disposed of by the Contractor in waste areas provided by him.

After the installation of the pipe lines the Contractor shall replace the removed curb and gutter with new concrete curb and gutter. The new concrete curb and gutter shall be constructed in accordance with detail drawing No. 501 in the City's "Roadway and Utility Standard Drawings" manual and all applicable provisions of Section 846 of the NCDOT 2002 Standard Specifications.

Curb and gutter removal and replacement quantities shall be computed using the actual trench width up to a maximum width equal to the nominal diameter of the pipe plus three feet. If, in the opinion of the Engineer, conditions beyond the Contractor's control require additional curb and gutter removal and replacement, a trench width greater than the nominal diameter of the pipe plus three feet will be used to compute the quantities.

Payment for removing and disposing of existing concrete curb and gutter and constructing new concrete curb and gutter will be made at the contract price per linear foot for "Remove and Replace 2'-6" Concrete Curb and Gutter".

The above prices and payments will be full compensation for all work of removing the existing curb and gutter and constructing new curb and gutter, including but not limited to excavation and backfilling, furnishing and placing concrete, construction joints, and disposal of all removed curb and gutter.

5.07 INCIDENTAL ABC STONE BASE

A. Description:

The work covered by this Article consists of furnishing and placing a graded stone material for use in driveways, pavement cuts, temporary maintenance of traffic, and at locations directed by the Engineer.

**B. Construction Requirements:**

The graded stone material shall meet the requirements of the NCDOT 2002 Standard Specifications for ABC Stone.

The graded stone material shall be uniformly spread over the area required and then shaped and dressed to the satisfaction of the Engineer. The stone material shall be maintained until final acceptance of the individual project by reshaping and by addition of stone material when directed by the Engineer.

In pavement cuts, the stone material shall be placed and compacted to 95% of Standard Proctor Density.

**C. Method of Measurement:**

The quantity of incidental stone to be paid for will be the actual number of tons of ABC stone which has been used as directed by the Engineer for driveways, pavement cuts, temporary maintenance of traffic, etc. The stone will be measured by being weighed in trucks on approved platform scales or by other approved weighing devices. No deduction will be made for any moisture contained in the stone at the time of weighing.

The Contractor shall exercise care in transporting and placing the incidental stone. Waste of stone shall be kept within reasonable limits as determined by the Engineer. The City reserves the right to deduct for payment stone that has been wasted by the Contractor through improper procedures or negligence.

**D. Basis of Payment:**

The quantity of incidental stone, measured as provided in Sub-Article 5.07 C., will be paid for at the contract unit price per ton for "Incidental ABC Stone Base".

The above price and payment will be full compensation for all work covered by this Article including but not limited to furnishing, hauling, placing, compacting, spreading, shaping and reshaping, dressing, and maintaining the incidental ABC stone base.

**5.08 CONCRETE ENCASEMENT OF MANHOLE AND VALVE BOX CASTINGS IN PAVEMENT**

The Contractor will be required to encase in concrete the iron castings of all proposed manholes and valve boxes that are to be installed within existing paved areas. The iron castings shall be encased in concrete in accordance with detail drawing No. 415 in the City's "Roadway and Utility Standard Drawings" manual.

No direct payment will be made for encasing the iron castings in concrete as such work will be considered incidental to other work being paid for under the various items in the contract. The work will include but not be limited to furnishing, placing, and compacting the concrete and any incidentals necessary to satisfactorily complete the work.

## 5.09 CLEARING AND GRUBBING

### A Description:

The work covered by this Article consists of cutting, removal, and satisfactory disposal of all trees, stumps, undergrowth, and debris that is within the construction right-of-way.

### B. Construction Requirements:

The clearing and grubbing shall be performed along the project at the locations designated on the drawings or directed by the Engineer. All brush, roots, stumps, tree limbs, trees not reserved by the property owner, undergrowth, and debris shall be disposed of by the Contractor in areas off of the site that are provided by him. The Contractor shall conduct his operations in a manner to prevent limb, bark, or root injuries to trees, shrubs, or other types of vegetation that are to remain growing and also to prevent damage to adjacent property. The Contractor shall exercise extreme caution in order not to clear and grub areas outside of the construction right-of-way.

Any areas of growth or individual trees which are to be preserved due to their desirability for landscape or erosion control purposes will be designated on the drawings or by the Engineer.

The Contractor shall perform such erosion control work, temporary or permanent, as may be directed by the Engineer in order to satisfactorily minimize erosion resulting from the clearing and grubbing operations.

Where designated on the drawings individual trees shall be limbed-up, cut into six foot lengths, and stacked outside of the construction right-of-way, as directed by the Engineer, for removal by the property owner.

### C. Method of Measurement:

All measurement of clearing and grubbing will be made horizontally.

The quantity of clearing and grubbing to be paid for will be the actual number of acres of area within the construction right-of-way which have been satisfactorily cleared and grubbed.

Measurement and payment for clearing and grubbing will be made only for areas that are designated on the drawings or directed by the Engineer to be cleared and grubbed.

### D Basis of Payment:

The quantity of clearing and grubbing, measured as provided in Sub-Article 5.09 C., will be paid for at the contract unit price per acre for "Clearing and Grubbing".

The above price and payment will be full compensation for all work covered by this Article including but not limited to the removal and disposal of all surface vegetation; the removal and disposal of all fences, steps, walls, footings, other foundation components, signs, junked vehicles, etc. that are not to be preserved and other rubble and debris; and the dressing up of all areas within the construction right-of-way.

## 5.10 SELECTIVE TREE REMOVAL

### A. Description:

The work covered by this Article consists of cutting, removal, and satisfactory disposal of selected trees, including the stump, within the construction right-of-way that are not designated on the drawings to be cleared and grubbed.

### B. Construction Requirements:

The trees that are to be removed will be designated on the drawings or by the Engineer. All tree stumps shall be grubbed. All brush, roots, stumps, tree laps, and trees not reserved by the property owner shall be disposed of by the Contractor in areas off of the site that are provided by him. The Contractor shall conduct his operations in a manner to prevent limb, bark, or root injuries to trees, shrubs, or other types of vegetation that are to remain growing and also to prevent damage to adjacent property. The Contractor shall exercise extreme caution in order not to remove any trees outside of the construction right-of-way.

The Contractor shall perform such erosion control work, temporary or permanent, as may be directed by the Engineer in order to satisfactorily minimize erosion resulting from the tree removal operations.

Where designated on the drawings individual trees shall be limbed-up, cut into six foot lengths, and stacked outside of the construction right-of-way, as directed by the Engineer, for removal by the property owner.

### C. Method of Measurement:

The quantity of selective tree removal to be paid for will be the actual number of qualifying trees which have been satisfactorily removed and disposed of. The diameter of each qualifying tree will be measured at a point four feet and six inches above the surface of the ground to determine the applicable pay item size as indicated below

<u>Pay Item Size</u>	<u>Actual Tree Diameter</u>
6 inch	4 inches up to 8 inches
10 inch	8 inches up to 12 inches
15 inch	12 inches up to 18 inches
18 inch	18 inches and over

### D. Basis of Payment:

The quantity of selective tree removal, measured as provided in Sub-Article 5.10 C., will be paid for at the contract price each for "Selective Tree Removal, \_\_\_\_ Inch".

The above price and payment will be full compensation for all work covered by this Article including but not limited to removing and disposing of designated trees, including stumps, and repairing any damage to vegetation that is to be preserved.

Payment will be made under:

Selective Tree Removal, 6 inch	EA
Selective Tree Removal, 10 inch	EA
Selective Tree Removal, 15 inch	EA
Selective Tree Removal, 18 inch	EA

#### 5.11 FENCE RESET

##### A. Description:

The work covered by this Article consists of removing and resetting existing fences of various types that are within the construction right-of-way and interfere with construction procedures.

##### B. Construction Requirements:

At the locations designated on the drawings or directed by the Engineer the Contractor shall remove and reset existing fences in accordance with the following provisions.

The following two cases will be defined for the removal and resetting of existing fences:

Case I is defined to cover woven wire or barbed wire fences.

Case II is defined to cover all types of fence other than woven wire and barbed wire fences.

The existing fence shall be removed and reset to the locations indicated on the drawings or directed by the Engineer. The fence, after resetting, shall be in a condition equal to or better than that existing before the fence was removed. The Contractor will be required to replace any of the fence components which have been unnecessarily damaged by him.

The Contractor shall maintain security of fenced areas that contain livestock during all phases of construction between the removal and resetting of the fence.

If the owner of the fence to be reset desires to repair, rebuild, or renew any parts of the fence, and agrees to furnish the materials without cost to the Contractor, then the Contractor shall repair, rebuild, renew, and reset such fence using the material furnished by the owner at no additional cost to the owner or the City.

##### C. Method of Measurement:

The quantity of fence reset to be paid for will be the actual number of linear feet of fence that has been acceptably reset. Measurement will be made along the fence after it has been reset from center of end post to center of end post.

##### D. Basis of Payment:

The quantity of fence reset, measured as provided in Sub-Article 5.11 C., will be paid for at the contract unit price per linear foot for "Reset Case \_\_\_\_ Fence".

The above price and payment will be full compensation for all work covered by this Article including but not limited to removing, hauling, and re-erecting the existing fence; and furnishing and installing any components unnecessarily damaged by the Contractor's forces.

Payment will be made under:

Reset Case I Fence	LF
Reset Case II Fence	LF

## 5.12 ENCASEMENT PIPE BY BORING AND JACKING METHOD

### A. Description:

The work covered by this Article consists of installing encasement pipe under roadways and railways by boring and jacking method.

### B. Construction Requirements:

The bore pit shall be no larger than that which is reasonably required to accommodate the boring and jacking operations. The location of the bore pit shall be, in all cases, as directed by the Engineer.

The Contractor will be required to take all reasonable precautions to prevent damage to the roadbed above when installing encasement pipe. Voids around the encasement pipe shall be kept to an absolute minimum. The Inspector shall have the authority to order boring discontinued where in his opinion damage to the roadway or railway appears likely. The Contractor shall take necessary measures to protect the roadbed before again commencing operations. Where excessive voids develop, such corrective action as is directed by the Engineer shall be taken.

When the encasement pipe is to be installed through rock, the Contractor shall make the bore using the appropriate rock bit.

Where encasement pipe is installed in State right-of-ways, the entire installation shall be as required by the NCDOT. Where encasement pipe is installed in Railroad right-of-ways, the entire installation shall be as required by the appropriate Railroad agency.

Brick headers shall be constructed at each end of the encasement pipe in such a manner as to minimize shear on the carrier pipe. When directed by the Engineer a drain outlet shall be provided at the low end of the encasement pipe.

The Contractor shall furnish and install carrier pipe spacers, as defined and installed per section 2.04, or as approved by the Engineer, on each pipe joint to keep the carrier pipe from floating or deflecting within the encasement pipe. No direct payment will be paid for these spacers as they are considered incidental to the work. The Contractor shall include spacers in his bid.

C. Method of Measurement:

The quantity of encasement pipe to be paid for will be the actual number of linear feet of encasement pipe that has been acceptably installed by boring and jacking method. Measurement will be made from face of bore to face of bore.

D. Basis of Payment:

The quantity of encasement pipe, measured as provided in Sub-Article 5.12 C., will be paid for at the contract unit price per linear foot for "Furnish and Install \_\_\_ Inch Encasement by Boring and Jacking Method", or at the contract unit price per linear foot for "Furnish and Install \_\_\_ Inch Encasement Through Rock".

5.13 REMOVE AND REPLACE DRIVEWAY PIPE

A. Description:

The work covered by this Article consists of removing and replacing existing driveway pipe that conflicts with the construction of water or sewer lines.

B. Construction Requirements:

The Contractor shall remove and stockpile existing driveway pipe that conflicts with the installation of the proposed pipe line or appurtenance. Immediately after the proposed pipe line or appurtenance has been installed, the Contractor shall replace the removed driveway pipe. The driveway pipe, after being replaced, shall be in a condition equal to or better than that existing before the pipe was removed. The Contractor will be required to replace, with new pipe, any of the existing driveway pipe unnecessarily damaged by him.

When, in the opinion of the Engineer, the existing driveway pipe is in such a poor condition that replacement would not be practicable or the pipe is of substandard material or size, the Engineer will authorize the use of new reinforced concrete pipe for replacement. The Contractor will be paid, on a Force Account basis, the actual invoice cost of the new pipe plus fifteen percent (15%) for profit and overhead. The Contractor shall dispose of the existing driveway pipe that was not replaced.

If the owner of the driveway pipe to be replaced desires and agrees to furnish new reinforced concrete pipe for replacement without cost to the Contractor, then the Contractor shall use the pipe furnished by the owner at no additional cost to the owner or the City. The Contractor shall dispose of the existing driveway pipe that was not replaced.

No direct payment, except pipe cost plus 15% as outlined above, will be made for any of the driveway pipe removal and replacement operations, as such work will be considered incidental to other work being paid for under the various bid items in the contract.



**EROSION AND SEDIMENTATION CONTROL**  
**SECTION 6**

**6.01 GENERAL DESCRIPTION**

The Contractor shall be required to take every reasonable precaution throughout the contract to prevent the erosion of soil and the sedimentation of streams, lakes, reservoirs, other water impoundments, ground surfaces, or other property as required by the Sedimentation Pollution Control Act of 1973 and the 1974 Amendments to the Act.

Failure on the part of the Contractor to comply with the provisions of the Erosion Control Plan or to perform erosion control work as directed will result in the Engineer, Inspector or NCDEHR notifying the Contractor to comply with these provisions. In the event that the Contractor fails to begin such remedial action or fails to begin erosion control work within 24 hours after receipt of such notice with adequate forces and equipment, the engineer may proceed to have the work performed with other forces. No payment will be made to the Contractor for work performed by others. Any costs incurred by the City due to the failure of the Contractor to comply with these provisions will be borne by the Contractor. Such costs will include civil penalties assessed for soil erosion and sedimentation control violations. Any costs incurred by the City for work performed by others as provided above in excess of the costs that would have been incurred had the work been performed by the Contractor will be deducted from retainage or other monies due the Contractor on his contract.

Temporary and permanent erosion control measures shall be as shown on the plans, as required by construction conditions, or as directed by the Engineer. All permanent erosion control work shall be incorporated into the work at the earliest practicable time. Temporary erosion control measures shall be coordinated with permanent erosion control measures and all other work on the project to assure economical, effective and continuous erosion control throughout the construction and post construction period and to minimize siltation of streams, lakes, reservoirs, other water impoundments, ground surface, or other property.

Temporary erosion control measures shall include but not be limited to swaled outfall right-of-way, silt fences, crushed stone check devices, silt basins (sedimentation traps), mulching, earth berms, and rip-rap.

Permanent erosion control measures shall include but not be limited to swaled outfall right-of-way and seeding of disturbed areas.

Temporary erosion control measures may include work outside of the construction right-of-way or limits where such work is necessary as a result of construction such as haul roads, equipment and material storage sites, borrow pit operations, and disposal of waste and debris. The Contractor shall develop an erosion control plan for the above areas that are outside the construction right-of-way or limits and submit the plan to the Regional Engineer for the North Carolina Department of Environmental Health and Natural Resources, Land Quality Section for review and approval. The Contractor shall restore the above areas to the satisfaction of the Engineer. The Contractor shall be responsible for all damages to public or private property arising out of his negligence in providing proper erosion control measures.

Materials for temporary and permanent erosion control measures shall have been approved by the Engineer before being used or shall be as directed by the Engineer.

The Contractor shall acceptably maintain erosion control measures installed by the Contractor, and all temporary erosion control devices shall be removed by the Contractor as directed by the Engineer.

#### 6.02 TIME ELEMENT IN EROSION CONTROL MEASURES

Temporary and permanent erosion control measures shall be carried out and coordinated to provide continuous erosion and siltation control from the pre-construction stage through the post-construction stage. Seeding and mulching or proper ground cover will be provided on exposed slopes within 15 working days following completion of any land-disturbing phase of construction. Permanent seeding and mulching or proper ground cover will be provided for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction of the water and sewer systems. Seeding and mulching shall be considered a part of construction for the purpose of estimate payments. Deviations from this procedure shall be only with the written authorization of the Engineer.

#### 6.03 EROSION CONTROL MEASURES

Erosion and siltation shall be controlled on this project. The Contractor shall take such action as is required to accomplish this objective, including but not limited to, the following measures:

1. A swale shall be constructed in the sewer outfall right-of-way to control run-off and convey the run-off from the disturbed area to controlled discharge points.
2. Silt fences, rip-rap, crushed stone, and earth berms shall be constructed as directed by the Engineer at discharge points in order to contain silt. On erodable slopes these devices shall be constructed as directed by the Engineer to inhibit erosion and prevent siltation.
3. The Contractor shall install pipe culverts at the locations where major access or haul roads cross drainage ditches or streams. In cases where access or haul roads cross large streams (as determined by the State) the Contractor may be required to bridge the stream crossing. The Engineer will determine the size of the pipe culvert at each location. Rip-rap shall be placed around both ends of the pipe culvert and silt basins constructed downstream from the culvert as directed by the Engineer. When directed by the specifications, plans or the Engineer, the Contractor shall adhere to the City of Greensboro Standard Sedimentation Control for Crossing Drainage Ditches or Streams during construction, Std. No. 213, and after construction, Std. No. 214, of the City of Greensboro Roadway and Utility Standard Drawings.

When the access or haul road is no longer required for construction purposes, the Contractor shall remove the pipe culvert or bridge and stabilize the disturbed drainage ditch or stream banks with rip-rap.

4. The Contractor shall construct silt basins at each location where pipe lines cross a drainage ditch or stream. The silt basin shall be constructed downstream from the crossing as directed by the Engineer. Immediately after the pipe line has been installed across the drainage ditch or stream, the Contractor shall stabilize the disturbed drainage ditch or stream banks with rip-rap.

5. The Contractor shall schedule and perform a continuous construction operation at all drainage ditches and stream crossings in order to minimize the time working in the drainage ditch or stream.
6. Seeding and mulching shall be employed as a permanent erosion control measure as soon after pipe installation as practicable.

After a temporary erosion control device has served its purpose it may be reused and paid for at other locations, (if covered by a pay item) providing it is still in satisfactory condition.

#### 6.04 TEMPORARY MULCHING

Temporary mulch may be used for the prevention of excessive soil erosion during construction operations where it is impossible or impractical to perform permanent seeding and mulching because of weather conditions. Temporary mulch shall be placed promptly when directed by the Engineer.

Temporary mulches may be straw, fiber mats, netting, bark, wood chips, or other suitable material acceptable to the Engineer and shall be reasonably clean and free of noxious weeds and deleterious material. Mulch shall be spread uniformly over the area by hand or by means of appropriate mechanical spreaders or blowers to obtain an application satisfactory to the Engineer. The Contractor shall apply a sufficient amount of asphalt or other type material to assure that the temporary mulch is properly held in place.

#### 6.05 SEEDING AND MULCHING

Seeding and mulching shall be done in accordance with all applicable provisions of Section 1660 of the NCDOT 2002 Standard Specifications, and the following provisions.

Seeding and mulching shall be done on all earth areas disturbed by construction or as designated by the Engineer. In roadway right-of-way the cleanup shall follow the construction such that seeding and mulching shall follow pipe laying as close as possible to avoid erosion of soil and subsequent siltation of streams.

#### Lawn Areas

All seeded areas subject to be mowed and maintained as lawn areas shall be prepared such that no secondary raking shall be necessary in order for a lawnmower to pass smoothly over the seeded area.

The kinds of seed, and fertilizer, and the rates of application of seed fertilizer, and limestone shall be as stated below.

All rates are in pounds per acre.

100 # Ky. 31 Tall Fescue or Alta Tall Fescue  
25 # Kenblue Bluegrass  
25 # Reliant Hard Fescue  
1000 # fertilizer  
4000 # limestone

Approved Kentucky Bluegrass Cultivars:

Kenblue	Glade	Adelphi	Baron	Bristol	Challenger
Columbia	Flyking	Merit	Plush	Ram I	Rugby
Sydsport	Touchdown	Vantage			

Approved Hard Fescue Cultivars:

Spartan	Scaldis	Aurora	Reliant	Valda	Crystal
Waldina					

Fertilizer shall be 10-20-20 analysis. Upon written approval of the Engineer a different analysis of fertilizer may be used, provided the 1-2-2 ratio is maintained and the rate of application adjusted to provide the same amount of plant food as a 10-20-20 analysis.

All Other Areas

The kinds of seed, and fertilizer, and the rates of application of seed fertilizer, and limestone shall be as stated below.

All rates are in pounds per acre.

4000 # agricultural limestone  
1000 # 10-10-10 fertilizer

(Note: lime and fertilizer are to be disked into the soil surface to a minimum depth of 4 inches)

Late Winter Early Spring

A. Grass:

1. Tall Fescue - 150 #

B. Grass - Legume Mixture:

1. Tall Fescue - 100 #, plus Serecia Lespedeza (scarified) 60 #
2. Tall Fescue - 100 #, plus Crownvetch - 25 #

Early Spring Late Spring

A. Grass:

1. Tall Fescue - 150 #
2. Tall Fescue - 100 #, plus Weeping Lovegrass - 5 #

B. Grass - Legume Mixture:

1. Tall Fescue - 100 # plus Serecia Lespedeza (scarified) 60 #

Summer

A. Grass:

1. Tall Fescue - 150 #, plus Weeping Lovegrass - 5 #
2. Weeping Lovegrass - 5 #, plus Browntop Millet or Sorghum-Sudan Hybrids-50 #

B. Grass - Legume Mixture:

1. Weeping Lovegrass - 5 #, plus Serecia Lespedeza (scarified) 60 #

Late Summer Early Winter

A. Grass:

1. Tall Fescue - 150 #

B. Grass - Legume Mixture:

1. Tall Fescue - 100 #, plus Serecia Lespedeza (unscarified) 60 #
2. Tall Fescue - 100 #, plus Crownvetch - 25 #
3. Tall Fescue - 75 #, plus Annual Ryegrass - 25 #, plus Serecia Lespedeza (unscarified) 60 #

After seeding, the area is to be rolled or cultipacked to insure that the seed is pressed into contact with the soil surface. All seeded areas are to be mulched with straw mulch at the rate of 3000# per acre (approximately 100 bales per acre).

Apply asphalt emulsion to the straw mulch at the rate of 150 gallons per acre.

The above seeding recommendations and rates have been prepared for selection of a vegetative cover suitable for soil erosion control in the Greensboro area.

Area soil types, climatic conditions, seed availability and individual plant characteristics are all taken into account in the above recommendations. Due to density, uniformity and textural quality reasons, the above selections are not recommended for lawn area use.

Payment will be made under:

Seeding and Mulching	AC
Seeding and Mulching, Lawn Areas	AC

6.06 SEED QUALITY REQUIREMENTS

The seed quality requirements shall be as follows:

1. Seed shall be entirely free from bulblets or seed of Bermuda Grass, Johnson Grass, Nutgrass, Sandbur, Wild Onion, Wild Garlic, Witchweed, and Crotalaria.
2. Seed shall not contain more than 2%, singly or collectively, of crop seed other than the kind or kinds of seed specified.
3. The limits of restricted noxious weed seed which are specified for the kinds of seed refer to the number per pound, singly or collectively, of cocklebur, blessed thistle, wildradish, Canada thistle, Corncockle, field bindweed, quackgrass, giant foxtail, dodders, dock, horsenettle, bracted plantain, buckhorn plantain, sicklepod, partridge pea, spurred anoda, velvetleaf, ragged robin, or wild mustard. However, in no case shall the number of cocklebur, blessed thistle, sicklepod, partridge pea, spurred anoda, or velvetleaf exceed 4 seeds of each per pound; the number of corncockle shall not exceed 10 seeds per pound; the number of wild radish shall not exceed 12 seeds per pound; the number of Canada thistle, field bindweed, ragged robin, or Texas panicum shall not exceed 27 seeds per

- pound; nor shall the number of quack grass, giant foxtail, dodder, dock, horsenettle, bracted plantain, buckhorn plantain, or wild mustard exceed 54 seeds of each per pound.
4. The seed quality requirements are as follows:  
Alta Fescue or Kentucky 31 Tall Fescue: Minimum 80% pure live seed; maximum 1% total weed seed; maximum 2% total other crop seed; maximum 100 restricted noxious weed seed per pound.

#### 6.07 PAYMENT FOR EROSION CONTROL

The Contractor will be paid for erosion control measures as follows:

1. Stone for Erosion Control:

The description of work, material requirements, construction methods, method of measurement, and basis of payment shall conform fully to Section 1610 of the NCDOT 2002 Standard Specifications.

The stone shall be placed in accordance with detail drawing No. 215 in the City's "Roadway & Utility Standard Drawings" manual or as directed by the Engineer.

Payment will be made under:

Stone for Erosion Control, Class ____	Ton
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2. Payment at the contract price per linear foot for "Temporary Silt Fence" shall be full compensation for all labor, tools, equipment, materials, and incidentals necessary to furnish, install, and maintain a silt fence; remove and dispose of collected silt and surplus spoil; and remove the silt fence when in the opinion of the Engineer, it is no longer needed for erosion control.

The quantity of silt fence to be paid for will be the actual number of linear feet of silt fence which has been satisfactorily installed at the locations shown on the drawings or at locations designated by the Engineer.

3. Payment at the contract price per acre for "Temporary Mulch" shall be full compensation for all labor, tools, equipment, and materials necessary to furnish and place temporary mulch for erosion control.

No payment will be made for temporary mulch that has been required because of the Contractor's failure to perform work properly or to seed and mulch the work according to schedule.

The quantity of temporary mulch to be paid for will be the number of acres, measured along the surface of the ground, over which temporary mulch has been placed as directed by the Engineer.

4. Matting for Erosion Control:

All matting material shall be excelsior matting.

The description of work, placing of matting, method of measurement, and basis of payment shall conform fully to Section 1631 of the NCDOT 2002 Standard Specifications.

Payment will be made under:

Matting for Erosion Control

SY

5. Payment at the contract price per acre for "Seeding and Mulching" shall be full compensation for all work of seeding and mulching including but not limited to furnishing all limestone, fertilizer, seed, mulch, asphalt, and other materials; cleanup of vegetation, stones, and other debris prior to seedbed preparation and mulching; seedbed preparation; applying and covering limestone, fertilizer, and seed; applying mulch; holding mulch; and maintenance.

The quantity of seeding and mulching to be paid for will be the actual number of acres of seeding and mulching, measured along the surface of the ground, which has been completed and accepted.

Rip-rap used for erosion control measures will be paid for at the contract unit price per square yard for "Plain Rip-Rap, Class \_\_\_\_" and shall be full compensation for all labor, equipment, materials, and incidentals necessary to furnish, haul, and place rip-rap for erosion control.

The rip-rap material shall meet the requirements of the NCDOT 2002 Standard Specifications for Plain Rip-Rap.

7. Earth Diversion Berm:

Payment at the contract unit price per linear foot for "Construct Earth Berm for Diversion" shall be full compensation for all labor, equipment, materials and incidentals necessary to construct and maintain an earthen diversion berm for erosion control.

The construction and maintenance of the diversion berm shall conform to the detail as shown on the plans.

8. Temporary Sediment Basin:

At the locations shown on the plans or as directed by the Engineer, the Contract will construct and maintain temporary sediment basins according to the dimensions shown on the plans. Upon completion of the project the Contractor shall remove the temporary sediment basin.

Payment for the work will be made at the contract unit price per each for "Temporary Sediment Basin - Construction and Removal". Such price and payment shall be considered full compensation for all labor, equipment, materials and incidentals necessary to construct, maintain and remove the temporary sediment basin for erosion control.

9. Filter Fabric for Rip Rap:

Filter fabric for rip rap used for erosion control measures will be paid for at the contract unit price per square yard for "Filter Fabric for Rip Rap" and shall be full compensation for all labor, equipment, materials and incidentals necessary to furnish and place filter fabric for rip rap.

Filter fabric for rip rap shall meet the requirements of the NCDOT's 2002 Specifications Section 1056 for engineering fabrics, Type 2.

10. Construction Entrance:

At the locations shown on the plans or as designated by the Engineer, the Contractor shall construct and maintain construction entrances. These will be paid for at the contract unit price per each for "Construction Entrance, C.O.G. Std. #217" and shall be full compensation for all labor, equipment, materials and incidentals necessary to furnish and maintain construction entrances.

11. No direct payment will be made for erosion control measures except as outlined above in Paragraphs (1) thru (10). The Contractor shall include in his bid the cost of any and all erosion control measures not included in Paragraphs (1) thru (10) that are required to satisfactorily control erosion and sedimentation throughout the construction of the project.

Also no direct payment will be made for any erosion control measures outside of the construction right-of-way that are necessary as a result of construction such as haul roads, equipment and material storage sites, borrow pit operations, disposal of waste and debris and any other operations that occur outside of the construction right-of-way.